DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 60

[Docket No. FAA–2002–12461; Notice No. 07–14]

RIN 2120–AJ12

Flight Simulation Training Device Initial and Continuing Qualification and Use

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of Proposed Rulemaking (NPRM).

SUMMARY: The FAA proposes to amend the Qualification Performance Standards (QPS) for flight simulation training devices (FSTD) and add a new level of simulation for helicopter flight training devices (FTD). The FAA proposes to codify existing practice by requiring all existing FSTD visual scenes that are beyond the number required for qualification to meet specified requirements. The proposal also reorganizes certain sections of the QPS appendices and provides additional information on validation tests, established parameters for tolerances, acceptable data formats, and the use of alternative data sources. The proposed changes would ensure that the training and testing environment is accurate and realistic, would codify existing practice, and would provide greater harmonization with the international standards document for simulation. None of these proposed technical requirements would apply to simulators qualified before May 30, 2008, except for the proposal to codify existing practice regarding certain visual scene requirements. The over-all impact of this proposal would result in minimal to no cost increases for manufacturers and sponsors.

DATES: Send your comments on or before December 21, 2007.

ADDRESSES: You may send comments identified by Docket Number FAA–2002–12461 using any of the following methods:

- *Federal eRulemaking Portal:* Go to *http://www.regulations.gov* and follow the online instructions for sending your comments electronically.
- *Mail:* Send comments to the Docket Management Facility; U.S. Department of Transportation, 1200 New Jersey Avenue, SE., West Building Ground Floor, Room W12–140, Washington, DC 20590–0001.
- *Hand Delivery or Courier:* Bring comments to the Docket Management Facility in Room W12–140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.
- *Fax:* Fax comments to the Docket Management Facility at 202–493–2251.

Privacy Act: We will post all comments we receive, without change, to *http://www.regulations.gov,* including any personal information you provide. Anyone is able to search the electronic form of all comments received into any of our dockets by the name of the individual submitting the comment (or signing the comment, if submitted on behalf of an association, business, labor union, etc.). You may review DOT's complete Privacy Act Statement in the **Federal Register** published on April 11, 2000 (65 FR 19477–78) or you may visit *http://DocketInfo.dot.gov.*

Docket: To read background documents or comments received, go to *http://www.regulations.gov* at any time and follow the online instructions for accessing the docket. Or, go to the Docket Management Facility in Room W12–140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Edward Cook, Air Transportation Division (AFS–200), Flight Standards Service, Federal Aviation Administration, 100 Hartsfield Centre Parkway, Suite 400, Atlanta, GA 30354; telephone: 404–832–4700.

SUPPLEMENTARY INFORMATION: Part 60 was originally added to Title 14 of the Code of Federal Regulations on October 30, 2006, with an effective date of October 30, 2007. In a document published in the Rules and Regulations section of this issue of the **Federal Register**, the effective date was delayed until May 30, 2008. This proposed rule would change the appendices of Part 60 originally published on October 30, 2006.

Later in this preamble under the Additional Information section, we discuss how you can comment on this proposal and how we will handle your comments. Included in this discussion is related information about the docket, privacy, and the handling of proprietary or confidential business information. We also discuss how you can get a copy of this proposal and related rulemaking documents.

Authority for This Rulemaking

The FAA's authority to issue rules regarding aviation safety is found in Title 49 of the United States Code. Subtitle I, Section 106 describes the authority of the FAA Administrator. Subtitle VII, Aviation Programs, describes in more detail the scope of the agency's authority. This rulemaking is promulgated under the authority described in Subtitle VII, Part A, subpart I, 49 U.S.C. 44701. Under that section, the FAA is charged with regulating air commerce in a way that best promotes safety.

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I. Summary of the Proposal

The primary purpose of this NPRM is to ensure that the training and testing environment is accurate and realistic and provide greater harmonization with the international standards document for simulation. The proposed requirements are expected to reduce expenses and workload for simulator sponsors by avoiding conflicting compliance standards. These modifications incorporate technological advances in, encourage innovation of, and standardize the initial and continuing qualification requirements for FSTDs that are consistent with the requirements recently established by the international flight simulation community.

The secondary purpose of this rulemaking project is to reorganize, simplify, and improve the readability of the QPS appendices. This proposal also clarifies and codifies certain standards presently contained in advisory circulars. In addition, the FAA proposes to amend the Qualification Performance

Standards (QPS) for flight simulation training devices (FSTD) and add a new level of simulation for helicopter flight training devices (FTD).

The FAA is proposing the following improvements to its FSTD qualification requirements:

- Provide a listing of the tasks for which a simulator may be qualified.
- Require the collection of objective test data during currently required aircraft certification testing for specific FSTD functions, including: Idle and emergency descents, and pitch trim rates for use in airplane simulators; engine inoperative rejected takeoffs for use in helicopter simulators; and takeoffs, hover, vertical climbs, and normal landings for use in helicopter flight training devices.
- Provide in the QPS additional information for sponsors on the testing requirements for FSTDs, including the use of alternative data sources when complete flight test data are not available or lesser technically complex levels of simulation are being developed.
- Clarify and standardize existing requirements for motion, visual, and sound systems, including subjective buffeting motions, visual scene content, and sound replication.
- By FSTD Directive require each Class II visual scene or airport model available in any FFS, regardless of the original qualification date, to meet the requirements described in Table A3C (Appendix A, Attachment 3) or Table C3C (Appendix C, Attachment 3), as appropriate.
- Clarify existing Quality Management System (QMS) requirements by removing non-regulatory information.

Except for the FSTD Directive, manufacturers and sponsors would not be required to incorporate any of the changes listed above for existing FSTDs. The appendices and attachments to part 60 affected by this proposal would only apply to FSTDs that come into service after part 60 is effective (currently May 30, 2008). The proposed changes to the QMS program would eliminate potentially confusing information that addresses the voluntary portions of a QMS program. The FAA anticipates that this proposal would result in minimal to no cost increases for manufacturers and sponsors.

II. Qualification Performance Standards (QPS) Amendment Process

The part 60 Final Rule contains six QPS appendices: Appendix A—Airplane Full Flight Simulators; Appendix B—Airplane Flight Training Devices; Appendix C—Helicopter Full Flight Simulators; Appendix D—Helicopter Flight Training Devices; Appendix E—Quality Management Systems for Flight Simulation Training Devices; and Appendix F—Definitions and Abbreviations for Flight Simulation Training Devices.

The QPS amendment process is faster than the traditional rulemaking process. It is designed to allow modifications to be implemented in a substantially shortened timeframe. In the part 60 Final Rule published October 30, 2006, (71 FR 63392), the FAA explained that the ''fast track'' QPS amendment process would be used to incorporate technical changes to flight simulation standards. The FAA anticipated QPS amendments based on several factors such as analysis of incident and accident data or changes in aircraft or simulation technology. Changes to the QPS documents are published in the **Federal Register** as an NPRM unless ''good cause'' exists under the Administrative Procedure Act (APA), which would warrant the FAA publishing a change to a QPS document without following the standard notice and comment procedures. Under the APA, in order for the FAA to issue a rule without following notice and comment procedures, the FAA would have to make a good cause finding that following notice and comment procedures would be impracticable, unnecessary, or contrary to the public interest.

Although proposed QPS amendments are published in the **Federal Register** for public comment, the authority for final review and issuance of the NPRM has been delegated from the Administrator to the Director of Flight Standards Service. The delegation of authority facilitates timely implementation of improved technological advances. This delegation of authority is exercised in conjunction with the Office of the Chief Counsel. If at any time during the amendment process the Administrator, Chief Counsel, or the Director of Flight Standards Service determines that a proposed amendment is not appropriate for the streamlined process, the rulemaking project would proceed in accordance with the agency's normal rulemaking procedures.

III. Background

A. Current Qualification Requirements

The FAA issued Part 60 to promote standardization and accountability for FSTD maintenance, qualification, and evaluation. The regulation codified the standards contained in advisory circulars and implemented the QPS format. The QPS appendices allow regulatory requirements and information to be presented in one location. This promotes ease of use and greater insight about the FAA's intent behind the regulation and the required and approved methods of compliance.

B. Harmonization With International Standards

During the development of the part 60 Final Rule, the international community also began updating flight simulation standards.[1] However, many of the changes recommended by the international community were beyond the scope of the part 60 NPRM and could not be included in the final rule. Rather than delay its efforts or issue a supplemental notice of proposed rulemaking, the FAA determined that the fastest approach would be to publish the part 60 Final Rule, delay the effective date, and amend the technical requirements under the expedited QPS amendment process. This approach avoided increased expenses, greater workload, and conflicting compliance requirements for sponsors who would be required to comply with part 60.

The majority of the proposed additions to the QPS provide information to the sponsors on objective tests. The information included explains why the tests are necessary, how to stage the simulator, and how to arrange other equipment to conduct the tests efficiently and produce optimum results. This information would be beneficial for simulator manufacturers and users.

The proposal clarifies and codifies the standards for motion, and visual and sound systems. The proposal also permits a new higher level of simulation for helicopter FTDs. The proposal adds 2 tables of material for operations tasks and system tasks, which are used as a reference when developing the statement of qualification for the FSTD. The proposal also includes a set of tables describing visual scene and airport model requirements for FSTD qualification.

Some of the proposed changes are marginally more stringent than the requirements in the October 30, 2006,

[1] The international community began releasing its recommendations with the publication of the International Civil Aviation Organization's Manual of Criteria for the Qualification of Flight Simulators (Document 9625) in 1994. The Joint Aviation Authorities of Europe issued JAA–STD–1A (Synthetic Training Device—document for airplane flight simulators) in 1998, followed by updates in 1999, 2001, and 2003. The first ICAO update of Document 9625 was in January of 2004 and the most recent consideration for update is the release of JAR–FSTD–A and JAR–FSTD–H documents in the late spring of 2005 for European national regulatory authorities to begin their review and consideration.

Final Rule. For example, a simulator qualified at Level C or Level D after May 30, 2008, would have the field of view and system capacity requirements for the visual system increased by 20 percent over the present requirement. The proposed requirements are consistent with international standards, which simulator manufacturers are currently following. This change improves the quality of simulation necessary to train and evaluate flight crewmembers. Other proposed changes are more flexible than the requirements prescribed in the October 30, 2006, Final Rule. For example, the tolerance for displacement in the control system ''freeplay'' test in helicopter simulators was increased from 0.10 inches to 0.15 inches, allowing additional space to adapt aircraft and non-aircraft hardware for use in the simulator.[2] This change was based on the FAA's belief that a 0.10 inch tolerance would create an undue hardship on sponsors because it would require constant adjustment of the controls to maintain the close tolerance. The change from 0.10 inches to 0.15 inches is large enough to minimize the hardship on sponsors, and small enough to continue providing pilots with an accurate controller feel.

Other than this change to the visual scene requirement, the requirements of this proposal would not apply to current simulators. In all instances the overall costs applicable to new simulators are minimal to none. The most expensive change being proposed is the increase in horizontal field of view for some visual system applications.

C. Compliance

With the exception of QMS requirements and any FSTD Directives, simulators qualified prior to May 30, 2008, are not required to meet QPS requirements as long as the simulator continues to meet the requirements contained in the Master Qualification Test Guide that was developed when the simulator was originally qualified.

IV. The Proposal

A. Visual Scenes and Airport Models; Class I, Class II, and Class III Airports; and the FSTD Directive for Class II Visual Scenes and Airport Models

Current part 60 contains requirements for the number of visual scenes or airport models that must be included for full flight simulator (FFS) qualification and a description of what the visual scenes or airport models must contain. Included in this proposal is a codification of existing practice for visual scene quality, environmental effects, visual feature recognition, and scene control and management capability. Also included is the codification of existing practice for updating visual scenes and airport visual models, including the identification of other aspects of the airport environment that would have to correspond with the visual scene or model.

The proposal establishes the requirements for Class I, Class II, and Class III visual scenes and airport models already covered by ACs issued by the FAA. For circling approaches, all of the proposed requirements would apply to the runway used for the initial approach and to the runway of intended landing. Additional proposed requirements include an accurate visual relationship between the scenes or airport models and other aspects of the airport environment, an accurate visual relationship of the aircraft and associated equipment, scene quality assessment features, and control of these scenes or models that the instructor is able to exercise. The FAA believes these requirements are necessary to ensure realistic and accurate depiction of airports and visual scenes incorporated in simulators for FAA-approved training programs.

Additional visual scenes or airport models beyond those necessary for simulator qualification may be used for various training program applications, including Line Oriented Flight Training, and are important for flight training and testing. Historically, these additional visual scenes or airport models were not routinely evaluated or required to meet any standardized criteria. This led to qualified simulators containing visual scenes or airport models that may have been incorrect or may have contained inappropriate visual references. To prevent this from occurring in the future, the FAA proposes to issue FSTD Directive (FD) Number 1. All FDs issued would be found in the FSTD Directive Attachments: Appendix A, Attachment 6; Appendix B, Attachment 5, Appendix C, Attachment 5, and Appendix D, Attachment 5. FD Number 1 is not contained in Appendix B or in Appendix D because no existing level of FSTD in Appendix B or Appendix D requires a visual system. Proposed FD Number 1 would require each simulator sponsor to verify that each Class II visual scene or airport model available in the FFS, regardless of the original qualification basis and regardless of the initial qualification date, meets the requirements in 14 CFR part 60, Appendix A, Attachment 3, Table A3C or Appendix C, Attachment 3, Table C3C, as applicable. FD Number 1 would apply to all FSTDs with visual systems containing visual scenes or airport models used as part of an FAA-approved curriculum that are available for use and are beyond the minimum number of required visual scenes or airport models required for qualification at the stated level. This FSTD Directive would not require visual scenes or airport models to contain details beyond the design capability of the existing qualified visual system. The availability of the scene or model in the FFS would serve as the sponsor's verification that the requirements were met. Therefore, a reporting requirement for these scenes or models would not be necessary. Currently, visual scenes and airport models available in any FFS that would be classified as Class II are likely to already meet the requirements being proposed. Additionally, each visual scene or airport model classified as Class II would be beyond the number of visual scenes or airport models required for qualification. In the event any Class II visual scene or airport model is found by the sponsor to be deficient in some way, the sponsor could remove that scene or model from the FFS library without jeopardizing the qualification status of the FFS. Alternately, the sponsor, at his or her option, may elect to bring the deficient aspect into compliance and retain the availability of that scene or model. Each sponsor has a full year to review each FFS during normal training, checking, or testing activities and determine the preferred course of action. For these reasons, the FAA has determined that in a few cases the cost for complying with this proposal would be minimal and in many cases there would be no cost to the sponsor.

In addition to the proposed requirements for Class II visual scenes and models, the FAA also proposes to allow the continuation of the use of visual scenes or airport models that have been approved by the Training Program Approval Authority (TPAA) for specific purposes. Examples of approved activities include specific airport or runway qualification, very low visibility operations training, including Surface Movement Guidance System (SMGS) operations, or use of a specific airport visual model aligned with an instrument procedure for another airport for instrument training. At the end of the interim period, all Class III visual scenes and airport models must be classified as either a Class I or a Class II visual scene or airport model or be removed from availability at the simulator Instructor

[2] See Appendix C of this part, Table C2A, item 2.a.6.

Operating Stations (IOS). Class III visual scenes and airport models may continue to be used after the end of the interim period if they are part of a training program specifically approved by the TPAA or other regulatory authority that uses a task and capability analysis as the basis for approval of this specific media element, (i.e., the specific scene or model selected for use in that program). Because any visual scene or airport model that may be classified as Class III is likely to already have some form of a task and capability analysis completed and is already specifically approved by the TPAA, the FAA has determined that in many cases there would be no cost for complying with this proposal. However, if a task and capability analysis is required or if modification to the visual scene is necessary, then the cost would be minimal.

B. New Requirements for Objective Testing Standards

The FAA proposes to revise the objective testing requirements for certain simulation performance areas. These revisions are necessary to clarify the instructions and requirements for certain tests contained in the final rule. In addition to changing the requirements for certain tests, the FAA also proposes several new tests that were not included in the final rule. The revised tests impact the following simulation performance areas:

1. Idle and emergency descents for airplane simulators.
2. Pitch trim rates for airplane simulators.
3. Landing test requirements: autopilot landings and ground effect demonstration for airplane simulators.
4. Takeoffs, hover, vertical climbs, and normal landings in helicopter flight training devices.
5. Spiral stability tests for both airplane and helicopter simulators.
6. Engine inoperative rejected takeoffs for helicopter simulators.
7. Motion System tests for airplane and helicopter simulators and for helicopter flight training devices.
8. Visual System tests for airplane and helicopter simulators and for helicopter flight training devices.
9. Sound System tests for airplane and helicopter simulators.

An example of a revised requirement is the spiral stability test for airplane and helicopter simulators. Under the proposal, an additional parameter must be measured to achieve the required results. For airplanes, the spiral stability test must be conducted in an additional flight configuration (approach or landing) instead of being conducted in cruise configuration only. For helicopters, the final rule required the helicopter to maintain the correct trend during the spiral stability test, whereas this proposal would require the helicopter to meet a specific roll or bank angle during the test. These additional parameters provide a more complete and accurate evaluation of the simulator, and ensure better replication of aircraft performance. The data that would be used to validate simulator performance and handling in these areas is obtained from lateral-directional stability tests conducted during normal aircraft certification flight testing. The data for these additional parameters are either regularly available or can be made available simply by activating the recording equipment when the test is begun.

Another example of the revised requirements is the inclusion of an alternative method for validating control dynamics for the pitch, roll, and yaw control tests for airplane simulators.[3] The alternative method would not change the requirements that the simulator must meet for qualification, but would allow the validation tests for control dynamics to be conducted on the ground rather than in-flight. The FAA believes this change would provide an equivalent level of safety, while conserving resources and providing greater flexibility for manufacturers and sponsors.

These proposed requirements affect only those FSTDs that will be coming into service after May 30, 2008, and some proposed changes may be marginally more stringent than the requirements in the October 30, 2006, Final Rule, while some are less stringent. Where the proposed requirements are marginally more stringent than the current requirements the cost would be minimal.

C. New Requirements for Motion Systems for Full Flight Simulators and Level 7 Helicopter Flight Training Devices

This proposal adds tables describing the motion vibration that must be displayed by the FSTD. The FAA proposes on-set motion cueing capability for airplane and helicopter FFSs and Level 7 helicopter FTDs. For the FFSs, the proposal includes a requirement that the motion cueing must be provided by a platform motion system. For the Level 7 helicopter FTDs, the proposal would allow a method other than a platform motion system to be used, such as the use of a large, bass speaker located beneath the pilot's seat with sufficient response to provide vibration cues to the pilot. The proposal also eliminates certain requirements for ranges and rates of motion system response for helicopter simulators. However, the proposal would require additional tests that capture the motion system ''signature.'' The signature is a simultaneous recording of motion system responses captured while conducting required objective tests. The signature is recorded and may be compared to signatures captured in subsequent evaluations to determine if any differences exist. Any differences would be corrected to return the motion system back to its original system operation. Signature testing would apply to airplane and helicopter simulators.

The October 30, 2006, Final Rule does not contain motion system testing requirements for airplane flight simulators. However, current practice (under the Advisory Circular) includes motion system testing that consists of ''frequency response,'' ''leg balance,'' and ''turn around check.'' This proposal codifies that current practice and adds the motion system benchmarking of a ''motion cueing performance signature'' and ''characteristic motion vibrations,'' both of which are also proposed for helicopter simulators. Motion cueing performance signature and characteristic motion vibrations for airplane flight simulators and helicopter simulators are already recorded during the conduct of other required objective and subjective testing for these simulators, thereby eliminating any cost.

The proposal also requires the recording of motion cueing performance signature and characteristic motion vibrations for simulators and Level 7 helicopter FTDs. The proposal only requires that the motion cueing performance signature and the characteristic motion vibrations be recorded while currently required tests are being conducted. The motion cueing performance signature is the motion system response recorded during certain objective tests. The characteristic motion vibrations are the motion system response recorded during certain subjective tests.

These proposed requirements would provide for more comprehensive simulator assessments. The additional cost for implementation would be either negligible or no cost. These requirements would also harmonize with the international standards document.

[3] See Appendix A of this part, Attachment 2, para. 4.

D. New Requirements for Visual Systems for Level C and D Full Flight Simulators

The FAA proposes technical changes for visual systems on Level C and Level D simulators. For example, the FAA proposes that the surface resolution of objects in the visual scene must be able to be visually ''resolved'' at 2 arc minutes rather than 3 arc minutes. Also, the horizontal field of view requirements would be increased from 150° to 180°. The FAA believes these requirements would provide better training to pilots by improving visual cues and better replicating the outside views. These changes would also be consistent with the current international standards. The requirements of this proposal would not apply to current simulators and the overall costs applicable to new simulators are minimal to none.

E. New Requirements for Sound Systems for Level D Simulators

The FAA proposes new sound testing requirements for new Level D simulators. These requirements would specify basic and special case sound tests, and would be consistent with existing FAA advisory material, FAA regulations, and the standards developed by the international simulation working group. The proposal contains a standardized list of sounds that would be recorded and compared during initial and subsequent qualification evaluations. All new level D simulators would be tested for frequency response and background noise. There would also be specific tests based on whether the simulator is replicating a jet powered aircraft or a propeller powered aircraft. These tests would ensure accuracy in the overall sound quality of the device. This proposal codifies existing practice of measuring sounds and will result in no additional cost to the sponsor. These changes would also be consistent with the current international standards. The FAA has always required Level D simulators to have sounds recorded. These sounds are then measured and compared between the aircraft and the simulator and adjusted until they match to within stated tolerances. However, under current requirements there are inconsistencies with what sounds are to be recorded and what tolerances should be applied. The proposal specifies the portions of the flight envelope that must be recorded, therefore eliminating the previous inconsistencies.

F. New Requirements for Subjective Testing Standards for Visual Scenes and Airport Models

The proposed requirements for visual scene and airport models for FFSs would codify existing advisory material, and include the following:

1. Scene content—1 airport scene required for Level A and B; 3 airport scenes required for Level C and D. The scenes must contain specific details, both on-airport and off-airport.
2. Visual scene management.
3. Visual scene recognition.
4. Airport model content.
5. Surrounding visual features consistent with the airport environment.
6. The quality of visual scene, including correct color and realistic textural cues.
7. Instructor control of environment, airport selection, and lighting.

These requirements would be necessary to ensure a training environment that provides accurate simulation and allows pilots to practice skills using visual scenes and models encountered in actual operations. These requirements would be particularly helpful for pilots with lower flight experience levels.

In addition to codifying standards for the required visual scenes and airport models, the FAA also proposes requirements for visual scenes and airport models that are included in the device by the sponsor, but are not required for the qualification level. In the past, there were no established standards for optional scenes or airport models that a sponsor may have incorporated in an FSTD. This created inconsistencies in approval methods and in the training credits issued for tasks completed in a device that had capability beyond what was required for the stated qualification level. By establishing minimum requirements for these optional scenes and models, the FAA would be requiring the sponsor of each FSTD to meet at least the minimum content, and the device may be eligible for additional training credits for pilots.

The visual scenes and airport models currently available in any FFS that would be classified as Class II are beyond the number of visual scenes or airport models required for qualification and are likely to already meet the requirements being proposed. As previously described, in the event any Class II visual scene or airport model is found by the sponsor to be deficient in some way, the sponsor could remove that scene or model from the FFS library without jeopardizing the qualification status of the FFS. However, the sponsor, at his option, may elect to bring the deficient aspect into compliance and retain the availability of that scene or model. Each sponsor has a full year to review each FFS during normal training, checking, or testing activities and determine the preferred course of action. For these reasons, the FAA has determined that in a few cases the cost for complying with this proposal would be minimal and in many cases there would be no cost to the sponsor.

G. New Level 7 Helicopter FSTD Requirements

The FAA is proposing a Level 7 Helicopter FTD QPS. There are currently no Level 7 helicopter FTDs. The standards proposed for this device would insure the quality of simulation necessary for the training and evaluation of flight crewmembers. The Level 7 FTD QPS would contain specific requirements for visual and motion systems. For example, the device would have to provide a visual system with a field of view of 150° x 40° for both pilots simultaneously and a motion cueing system that may consist of a platform motion system, a seat shaker system, or a strategically located bass speaker of sufficient response to provide an indication of rotor vibration and vibration changes with changes in RPM or collective input. The Level 7 device would expand the training capability for helicopter students. Because the Level 7 FTD is a new voluntary training option and would not be required for compliance with any training, testing or checking requirements, the proposal would not impose any additional cost on sponsors or manufacturers.

H. Quality Management Systems

The October 30, 2006, Final Rule established a Quality Management System (QMS) for FSTDs. The QMS is divided into two separate categories—a mandatory program and a voluntary program. This proposal would remove the details regarding the voluntary program from Appendix E. The proposal also clarifies the obligation of sponsors to be consistent in their conduct of internal assessments and clarifies the potential for increase in internal audit intervals.

Under the proposal, the National Simulator Program Manager (NSPM) would conduct continuing qualification evaluations of each FSTD every 12 months unless the NSPM becomes aware of discrepancies or performance problems with the device that warrants more frequent evaluations. The continuing qualification evaluations frequency could be extended beyond the 12-month interval if: (1) The sponsor

implements a voluntary QMS program; and (2) the NSPM determines that the administration of the QMS program and the FSTD performance justifies less frequent evaluations. However, in no case would the frequency of continuing qualification evaluations exceed 36 months.

I. New Information on Operation and Testing Requirements for FSTDs

The QPS material attached to this proposed rule adds 11 paragraphs of information to better explain the operation and testing requirements for FSTDs. The paragraphs provide information on the use of alternative data sources, alternative engines data, alternative avionics data, and engineering simulators to provide validation data. There are also information paragraphs on motion systems, sound systems, simulator qualifications for new or derivative airplanes, validation test tolerances, validation data roadmap, transport delay testing, and validation test data presentation.

V. Regulatory Notices and Analyses

Privacy Impact Statement for Proposed 14 CFR Part 60, Appendices A Through F

Legal Requirements

Section 522 of the Consolidated Appropriations Act of 2005 instructs DOT to conduct a privacy impact assessment (PIA) of proposed rules that will affect the privacy of individuals. The PIA should identify potential threats relating to the collection, handling, use, sharing and security of the data, the measures identified to mitigate these threats, and the rationale for the final decisions made for the rulemaking as a result of conducting the PIA.

Definitions

Sponsor means a certificate holder who seeks or maintains FSTD qualification and is responsible for the prescribed actions as prescribed in this part and the QPS for the appropriate FSTD and qualification level.

Certificate holder means a person issued a certificate under parts 119, 141, or 142 of this chapter or a person holding an approved course of training for flight engineers in accordance with part 63 of this chapter.

Individual means a living human being, specifically including a citizen of the United States or an alien lawfully admitted for permanent residence.

Personally Identifiable Information (PII) is any information that permits the identity of an individual to whom the information applies to be reasonably inferred by either direct or indirect means, singly or in combination with other data. Examples of PII include but are not limited to physical and online contact information, Social Security number or driver's license number.

Privacy Impact Assessment is an analysis of how a rulemaking would impact the way information is handled in order to ensure data handling conforms to applicable legal, regulatory, and policy requirements regarding privacy, determine the risks and effects the rulemaking will have on collecting, maintaining and sharing PII, and examine and evaluate protections and alternative processes for handling information to mitigate potential privacy risks.

Requirements for the Submission and Retention of PII as Part of Compliance With Proposed 14 CFR part 60, Flight Simulation Training Device Initial and Continuing Qualification and Use

The FAA proposes to amend the QPS requirements for FSTDs. Compliance with the QPS requirements is the responsibility of the FSTD sponsor. There are approximately 60 FSTD sponsors.

The proposed rule does not require sponsors to submit PII to the FAA or to maintain PII in their own records. However, the FAA recognizes that certain PII may be contained in a sponsor's records, including information about individuals who have used a particular FSTD. This information may include the person's name, employer, duty position, and type ratings. The FAA may request a sponsor to disclose this PII for investigation, compliance, or enforcement purposes. For example, the FAA may request the sponsor to provide the names of all individuals trained on a specific device if the FAA discovered that the device was not adequately simulating the aircraft and determined that those individuals needed to be retrained or reevaluated.

The FAA protects PII in accordance with *''Privacy Act Notice DOT/FAA 847—Aviation Records on Individuals (formerly General Air Transportation Records on Individuals).''* The Privacy Act Notice is available at *http://cio.ost.dot.gov/DOT/OST/Documents/files/records.html*.

The FAA did not conduct a PIA for this rulemaking because there are no new requirements for PII as part of these QPS amendments. In August 2004, the FAA released a PIA for airmen certification records. The PIA addresses the methodology the agency uses to collect, store, distribute, and protect PII for certificated airmen, including pilots. The PIA is available at *http://www.dot.gov/pia/faa_rms.htm*. This PIA would apply to any PII the FAA may receive from a sponsor in the course of exercising its oversight authority.

For more information or for comments and concerns on our privacy practices, please contact our Privacy Officer, Carla Mauney at *carla.mauney@faa.gov,* or by phone at (202) 267–9895.

Paperwork Reduction Act

Information collection requirements associated with this NPRM have been approved previously by the Office of Management and Budget (OMB) under the provisions of the Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)) and have been assigned OMB Control Number 2120–0680.

International Compatibility

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to comply with International Civil Aviation Organization (ICAO) Standards and Recommended Practices to the maximum extent practicable. The FAA has reviewed the corresponding ICAO Standards and Recommended Practices and has identified no differences with these proposed regulations.

Economic Assessment, Initial Regulatory Flexibility Determination, Trade Impact Assessment, and Unfunded Mandates Assessment

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 (Pub. L. 96–354) requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (Pub. L. 96–39) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, the Trade Act requires agencies to consider international standards and, where appropriate, that they be the basis of U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by the private sector, of $100 million or more annually (adjusted

for inflation with base year of 1995). This portion of the preamble summarizes the FAA's analysis of the economic impacts of this proposed rule.

Department of Transportation Order DOT 2100.5 prescribes policies and procedures for simplification, analysis, and review of regulations. If the expected cost impact is so minimal that a proposed or final rule does not warrant a full evaluation, this order permits that a statement to that effect and the basis for it to be included in the preamble if a full regulatory evaluation of the cost and benefits is not prepared. Such a determination has been made for this proposed rule. The reasoning for this determination follows:

The FAA proposes to codify existing practice by requiring all existing FSTD visual scenes beyond the number required for qualification to meet specified requirements. The proposal also reorganizes certain sections of the QPS appendices and provides additional information on validation tests, established parameters for tolerances, acceptable data formats, and the use of alternative data sources. The proposed changes would ensure that the training and testing environment is accurate and realistic, would codify existing practice, and would provide greater harmonization with the international standards document for simulation. None of these proposed technical requirements would apply to simulators qualified before May 30, 2008, except for the proposal to codify existing practice regarding certain visual scene requirements. The overall impact of this proposal would result in minimal to no cost increases for manufacturers and sponsors.

The FAA has, therefore, determined that this proposed rule is not a ''significant regulatory action'' as defined in section 3(f) of Executive Order 12866, and is not ''significant'' as defined in DOT's Regulatory Policies and Procedures.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (Pub. L. 96–354) (RFA) establishes ''as a principle of regulatory issuance that agencies shall endeavor, consistent with the objectives of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the businesses, organizations, and governmental jurisdictions subject to regulation. To achieve this principle, agencies are required to solicit and consider flexible regulatory proposals and to explain the rationale for their actions to assure that such proposals are given serious consideration.'' The RFA covers a wide-range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions.

Agencies must perform a review to determine whether a rule will have a significant economic impact on a substantial number of small entities. If the agency determines that it will, the agency must prepare a regulatory flexibility analysis as described in the RFA.

However, if an agency determines that a rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the RFA provides that the head of the agency may so certify and a regulatory flexibility analysis is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

The FAA proposes to codify existing practice by requiring all existing FSTD visual scenes beyond the number required for qualification to meet specified requirements. The proposal also reorganizes certain sections of the QPS appendices and provides additional information on validation tests, established parameters for tolerances, acceptable data formats, and the use of alternative data sources. The proposed changes would ensure that the training and testing environment is accurate and more realistic, would codify existing practice, and would provide greater harmonization with the international standards document for simulation. None of these proposed technical requirements would apply to simulators qualified before May 30, 2008, except for the proposal to codify existing practice regarding certain visual scene requirements. The overall impact of this proposal would result in minimal to no cost increases for manufacturers and sponsors. Therefore the FAA certifies that this proposed rule would not have a significant economic impact on a substantial number of small entities. The FAA solicits comments regarding this determination.

International Trade Impact Assessment

The Trade Agreements Act of 1979 (Pub. L. 96–39) prohibits Federal agencies from establishing any standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. Legitimate domestic objectives, such as safety, are not considered unnecessary obstacles. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards. The FAA has assessed the potential effect of this proposed rule and has determined that it would impose the same costs on domestic and international entities and thus has a neutral trade impact.

Unfunded Mandates Assessment

Title II of the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires each Federal agency to prepare a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in an expenditure of $100 million or more (adjusted annually for inflation with the base year 1995) in any one year by State, local, and tribal governments, in the aggregate, or by the private sector; such a mandate is deemed to be a ''significant regulatory action.'' The FAA currently uses an inflation-adjusted value of $128.1 million in lieu of $100 million. This proposed rule does not contain such a mandate.

Executive Order 13132, Federalism

The FAA has analyzed this notice of proposed rulemaking under the principles and criteria of Executive Order 13132, Federalism. We determined that this proposal will not have a substantial direct effect on the States, on the relationship between the national Government and the States, or on the distribution of power and responsibilities among the various levels of government. Therefore, we determined that this proposed rule will not have federalism implications.

Environmental Analysis

FAA Order 1050.1E identifies FAA actions that are categorically excluded from preparation of an environmental assessment or environmental impact statement under the National Environmental Policy Act in the absence of extraordinary circumstances. The FAA has determined this proposed rule action qualifies for the categorical exclusion identified in paragraph 312f and involves no extraordinary circumstances.

Regulations That Significantly Affect Energy Supply, Distribution, or Use

The FAA has analyzed this proposed rule under Executive Order 13211, Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use (May 18, 2001). We have determined that it is not a ''significant energy action'' under the executive order because it is not a ''significant regulatory action'' under Executive Order 12866, and it is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

Additional Information

Comments Invited

The FAA invites interested persons to participate in this rulemaking by submitting written comments, data, or views. We also invite comments relating to the economic, environmental, energy, or federalism impacts that might result from adopting the proposals in this document. The most helpful comments reference a specific portion of the proposal, explain the reason for any recommended change, and include supporting data. To ensure the docket does not contain duplicate comments, please send only one copy of written comments, or if you are filing comments electronically, please submit your comments only one time.

We will file in the docket all comments we receive, as well as a report summarizing each substantive public contact with FAA personnel concerning this proposed rulemaking. Before acting on this proposal, we will consider all comments we receive on or before the closing date for comments. We will consider comments filed after the comment period has closed if it is possible to do so without incurring expense or delay. We may change this proposal in light of the comments we receive.

Proprietary or Confidential Business Information

Do not file in the docket information that you consider to be proprietary or confidential business information. Send or deliver this information directly to the person identified in the **FOR FURTHER INFORMATION CONTACT** section of this document. You must mark the information that you consider proprietary or confidential. If you send the information on a disk or CD–ROM, mark the outside of the disk or CD–ROM and also identify electronically within the disk or CD–ROM the specific information that is proprietary or confidential.

Under 14 CFR 11.35(b), when we are aware of proprietary information filed with a comment, we do not place it in the docket. We hold it in a separate file to which the public does not have access, and we place a note in the docket that we have received it. If we receive a request to examine or copy this information, we treat it as any other request under the Freedom of Information Act (5 U.S.C. 552). We process such a request under the DOT procedures found in 49 CFR part 7.

Availability of Rulemaking Documents

You can get an electronic copy of rulemaking documents using the Internet by—

1. Searching the Federal eRulemaking Portal (*http://www.regulations.gov*);

2. Visiting the FAA's Regulations and Policies Web page at *http://www.faa.gov/regulations_policies/; or*

3. Accessing the Government Printing Office's Web page at *http://www.gpoaccess.gov/fr/index.html.*

You can also get a copy by sending a request to the Federal Aviation Administration, Office of Rulemaking, ARM–1, 800 Independence Avenue, SW., Washington, DC 20591, or by calling (202) 267–9680. Make sure to identify the docket number, notice number, or amendment number of this rulemaking.

List of Subjects in 14 CFR Part 60

Airmen, Aviation safety, Reporting and recordkeeping requirements.

The Proposed Amendment

In consideration of the foregoing, the Federal Aviation Administration proposes to further amend the final rule amending part 60 of Title 14 of the Code of Federal Regulations, as published at 71 FR 63392 on October 30, 2006, as follows:

PART 60—FLIGHT SIMULATION TRAINING DEVICE INITIAL AND CONTINUING QUALIFICATION AND USE

1. The authority citation for part 60 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, and 44701.

2. Part 60, published at 71 FR 63392 on October 30, 2006 is amended by revising appendices A–F to read as follows:

Appendix A to Part 60—Qualification Performance Standards for Airplane Full Flight Simulators

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Begin Information

This appendix establishes the standards for Airplane Full Flight Simulator (FFS) evaluation and qualification. The Flight Standards Service, National Simulator Program Manager (NSPM), is responsible for the development, application, and implementation of the standards contained within this appendix. The procedures and criteria specified in this appendix will be used by the NSPM, or a person assigned by the NSPM, when conducting airplane FFS evaluations.

Table of Contents

End Information

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1. Introduction

Begin Information

a. This appendix contains background information as well as regulatory and informative material as described later in this section. To assist the reader in determining what areas are required and what areas are permissive, the text in this appendix is divided into two sections: ''QPS Requirements'' and ''Information.'' The QPS Requirements sections contain details regarding compliance with the part 60 rule

language. These details are regulatory, but are found only in this appendix. The Information sections contain material that is advisory in nature, and designed to give the user general information about the regulation.

b. Questions regarding the contents of this publication should be sent to the U.S. Department of Transportation, Federal Aviation Administration, Flight Standards Service, National Simulator Program Staff, AFS–205, 100 Hartsfield Centre Parkway, Suite 400, Atlanta, Georgia, 30354. Telephone contact numbers for the NSP are: phone, 404–832–4700; fax, 404–761–8906. The general email address for the NSP office is: *9-aso-avr-sim-team@faa.gov.* The NSP Internet Web Site address is: *http://www.faa.gov/safety/programs_initiatives/aircraft_aviation/nsp/.* On this Web Site you will find an NSP personnel list with telephone and email contact information for each NSP staff member, a list of qualified flight simulation devices, advisory circulars, a description of the qualification process, NSP policy, and an NSP ''In-Works'' section. Also linked from this site are additional information sources, handbook bulletins, frequently asked questions, a listing and text of the Federal Aviation Regulations, Flight Standards Inspector's handbooks, and other FAA links.

c. The NSPM encourages the use of electronic media for all communication, including any record, report, request, test, or statement required by this appendix. The electronic media used must have adequate security provisions and be acceptable to the NSPM. The NSPM recommends inquiries on system compatibility, and minimum system requirements are also included on the NSP Web site.

d. Related Reading References.

(1) 14 CFR part 60.

(2) 14 CFR part 61.

(3) 14 CFR part 63.

(4) 14 CFR part 119.

(5) 14 CFR part 121.

(6) 14 CFR part 125.

(7) 14 CFR part 135.

(8) 14 CFR part 141.

(9) 14 CFR part 142.

(10) Advisory Circular (AC) 120–28C, Criteria for Approval of Category III Landing Weather Minima.

(11) AC 120–29, Criteria for Approving Category I and Category II Landing Minima for part 121 operators.

(12) AC 120–35B, Line Operational Simulations: Line-Oriented Flight Training, Special Purpose Operational Training, Line Operational Evaluation.

(13) AC 120–41, Criteria for Operational Approval of Airborne Wind Shear Alerting and Flight Guidance Systems.

(14) AC 120–57A, Surface Movement Guidance and Control System (SMGS).

(15) AC 150/5300–13, Airport Design.

(16) AC 150/5340–1G, Standards for Airport Markings.

(17) AC 150/5340–4C, Installation Details for Runway Centerline Touchdown Zone Lighting Systems.

(18) AC 150/5340–19, Taxiway Centerline Lighting System.

(19) AC 150/5340–24, Runway and Taxiway Edge Lighting System.

(20) AC 150/5345–28D, Precision Approach Path Indicator (PAPI) Systems.

(21) International Air Transport Association document, ''Flight Simulator Design and Performance Data Requirements,'' as amended.

(22) AC 25–7, as amended, Flight Test Guide for Certification of Transport Category Airplanes.

(23) AC 23–8A, as amended, Flight Test Guide for Certification of Part 23 Airplanes.

(24) International Civil Aviation Organization (ICAO) Manual of Criteria for the Qualification of Flight Simulators, as amended.

(25) Airplane Flight Simulator Evaluation Handbook, Volume I, as amended and Volume II, as amended, The Royal Aeronautical Society, London, UK.

(26) FAA Publication FAA–S–8081 series (Practical Test Standards for Airline Transport Pilot Certificate, Type Ratings, Commercial Pilot, and Instrument Ratings).

(27) The FAA Aeronautical Information Manual (AIM). An electronic version of the AIM is on the Internet at *http://www.faa.gov/atpubs.*

End Information

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2. Applicability (§§ 60.1 and 60.2)

Begin Information

No additional regulatory or informational material applies to § 60.1, Applicability, or to § 60.2, Applicability of sponsor rules to persons who are not sponsors and who are engaged in certain unauthorized activities.

End Information

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3. Definitions (§ 60.3)

Begin Information

See Appendix F of this part for a list of definitions and abbreviations from part 1 and part 60, including the appropriate appendices of part 60.

End Information

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4. Qualification Performance Standards (§ 60.4)

Begin Information

No additional regulatory or informational material applies to § 60.4, Qualification Performance Standards.

End Information

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5. Quality Management System (§ 60.5)

Begin Information

See Appendix E of this part for additional regulatory and informational material regarding Quality Management Systems.

End Information

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6. Sponsor Qualification Requirements (§ 60.7)

Begin Information

a. The intent of the language in § 60.7(b) is to have a specific FFS, identified by the sponsor, used at least once in an FAA-approved flight training program for the airplane simulated during the 12-month period described. The identification of the specific FFS may change from one 12-month period to the next 12-month period as long as the sponsor sponsors and uses at least one FFS at least once during the prescribed period. No minimum number of hours or minimum FFS periods are required.

b. The following examples describe acceptable operational practices:

(1) Example One.

(a) A sponsor is sponsoring a single, specific FFS for its own use, in its own facility or elsewhere—this single FFS forms the basis for the sponsorship. The sponsor uses that FFS at least once in each 12-month period in the sponsor's FAA-approved flight training program for the airplane simulated. This 12-month period is established according to the following schedule:

(i) If the FFS was qualified prior to May 30, 2008, the 12-month period begins on the date of the first continuing qualification evaluation conducted in accordance with § 60.19 after May 30, 2008, and continues for each subsequent 12-month period;

(ii) A device qualified on or after May 30, 2008, will be required to undergo an initial or upgrade evaluation in accordance with § 60.15. Once the initial or upgrade evaluation is complete, the first continuing qualification evaluation will be conducted within 6 months. The 12-month continuing qualification evaluation cycle begins on that date and continues for each subsequent 12-month period.

(b) There is no minimum number of hours of FFS use required.

(c) The identification of the specific FFS may change from one 12-month period to the next 12-month period as long as the sponsor sponsors and uses at least one FFS at least once during the prescribed period.

(2) Example Two.

(a) A sponsor sponsors an additional number of FFSs, in its facility or elsewhere. Each additionally sponsored FFS must be—

(i) Used by the sponsor in the sponsor's FAA-approved flight training program for the airplane simulated (as described in § 60.7(d)(1)); OR

(ii) Used by another FAA certificate holder in that other certificate holder's FAA-approved flight training program for the airplane simulated (as described in § 60.7(d)(1)). This 12-month period is established in the same manner as in example one; OR

(iii) Provided a statement each year from a qualified pilot, (after having flown the airplane, not the subject FFS or another FFS, during the preceding 12-month period) stating that the subject FFSs performance and handling qualities represent the airplane (as described in § 60.7(d)(2)). This statement is provided at least once in each 12-month period established in the same manner as in example one.

(b) No minimum number of hours of FFS use is required.

(3) Example Three.

(a) A sponsor in New York (in this example, a Part 142 certificate holder) establishes ''satellite'' training centers in Chicago and Moscow.

(b) The satellite function means that the Chicago and Moscow centers must operate under the New York center's certificate (in accordance with all of the New York center's practices, procedures, and policies; e.g., instructor and/or technician training/checking requirements, record keeping, QMS program).

(c) All of the FFSs in the Chicago and Moscow centers could be dry-leased (i.e., the certificate holder does not have and use FAA-approved flight training programs for the FFSs in the Chicago and Moscow centers) because—

(i) Each FFS in the Chicago center and each FFS in the Moscow center is used at least once each 12-month period by another FAA certificate holder in that other certificate holder's FAA-approved flight training program for the airplane (as described in § 60.7(d)(1)); or

(ii) A statement is obtained from a qualified pilot (having flown the airplane, not the subject FFS or another FFS during the preceding 12-month period) stating that the performance and handling qualities of each FFS in the Chicago and Moscow centers represents the airplane (as described in § 60.7(d)(2)).

End Information

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7. Additional Responsibilities of the Sponsor (§ 60.9)

Begin Information

The phrase ''as soon as practicable'' in § 60.9(a) means without unnecessarily disrupting or delaying beyond a reasonable time the training, evaluation, or experience being conducted in the FSTD.

End Information

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8. FSTD Use (§ 60.11)

Begin Information

No additional regulatory or informational material applies to § 60.11, Simulator Use.

End Information

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9. FSTD Objective Data Requirements (§ 60.13)

Begin QPS Requirements

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a. Flight test data used to validate FFS performance and handling qualities must have been gathered in accordance with a flight test program containing the following:

(1) A flight test plan consisting of:

(a) The maneuvers and procedures required for aircraft certification and simulation programming and validation.

(b) For each maneuver or procedure—

(i) The procedures and control input the flight test pilot and/or engineer used.

(ii) The atmospheric and environmental conditions.

(iii) The initial flight conditions.

(iv) The airplane configuration, including weight and center of gravity.

(v) The data to be gathered.

(vi) All other information necessary to recreate the flight test conditions in the FFS.

(2) Appropriately qualified flight test personnel.

(3) An understanding of the accuracy of the data to be gathered using appropriate alternative data sources, procedures, and instrumentation that is traceable to a recognized standard as described in Attachment 2, Table A2E.

(4) Appropriate and sufficient data acquisition equipment or system(s), including appropriate data reduction and analysis methods and techniques, as would be acceptable to the FAA's Aircraft Certification Service.

b. The data, regardless of source, must be presented:

(1) In a format that supports the FFS validation process;

(2) In a manner that is clearly readable and annotated correctly and completely;

(3) With resolution sufficient to determine compliance with the tolerances set forth in Attachment 2, Table A2A of this appendix.

(4) With any necessary instructions or other details provided, such as yaw damper or throttle position; and

(5) Without alteration, adjustments, or bias; however the data may be re-scaled, digitized, or otherwise manipulated to fit the desired presentation.

c. After completion of any additional flight test, a flight test report must be submitted in support of the validation data. The report must contain sufficient data and rationale to support qualification of the FFS at the level requested.

d. As required by § 60.13(f), the sponsor must notify the NSPM when it becomes aware that an addition to, an amendment to, or a revision of data that may relate to FFS performance or handling characteristics is available. The data referred to in this paragraph are those data that are used to validate the performance, handling qualities, or other characteristics of the aircraft, including data related to any relevant changes occurring after the type certificate was issued. The sponsor must—

(1) Within 10 calendar days, notify the NSPM of the existence of this data; and

(2) Within 45 calendar days, notify the NSPM of—

(a) The schedule to incorporate this data into the FFS; or

(b) The reason for not incorporating this data into the FFS.

e. In those cases where the objective test results authorize a ''snapshot test'' or a ''series of snapshot tests'' results in lieu of a time-history result, the sponsor or other data provider must ensure that a steady state condition exists at the instant of time captured by the ''snapshot.'' The steady state condition must exist from 4 seconds prior to, through 1 second following, the instant of time captured by the snapshot.

End QPS Requirements

Begin Information

f. The FFS sponsor is encouraged to maintain a liaison with the manufacturer of the aircraft being simulated (or with the holder of the aircraft type certificate for the aircraft being simulated if the manufacturer is no longer in business), and, if appropriate, with the person having supplied the aircraft data package for the FFS in order to facilitate the notification required by § 60.13(f).

g. It is the intent of the NSPM that for new aircraft entering service, at a point well in advance of preparation of the Qualification Test Guide (QTG), the sponsor should submit to the NSPM for approval, a descriptive document (a validation data roadmap) containing the plan for acquiring the validation data, including data sources. This document should clearly identify sources of data for all required tests, a description of the validity of these data for a specific engine type and thrust rating configuration, and the revision levels of all avionics affecting the performance or flying qualities of the aircraft. Additionally, this document should provide other information, such as the rationale or explanation for cases where data or data parameters are missing, instances where engineering simulation data are used or where flight test methods require further explanations. It should also provide a brief narrative describing the cause and effect of any deviation from data requirements. The aircraft manufacturer may provide this document.

h. There is no requirement for any flight test data supplier to submit a flight test plan or program prior to gathering flight test data. However, the NSPM notes that inexperienced data gatherers often provide data that is irrelevant, improperly marked, or lacking adequate justification for selection. Other problems include inadequate information regarding initial conditions or test maneuvers. The NSPM has been forced to refuse these data submissions as validation data for an FFS evaluation. It is for this reason that the NSPM recommends that any data supplier not previously experienced in this area review the data necessary for programming and for validating the performance of the FFS, and discuss the flight test plan anticipated for acquiring such data with the NSPM well in advance of commencing the flight tests.

i. The NSPM will consider, on a case-by-case basis, whether or not to approve supplemental validation data derived from flight data recording systems such as a Quick Access Recorder or Flight Data Recorder.

End Information

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10. Special Equipment and Personnel Requirements for Qualification of the FSTDs (§ 60.14)

Begin Information

a. In the event that the NSPM determines that special equipment or specifically qualified persons will be required to conduct

an evaluation, the NSPM will make every attempt to notify the sponsor at least one (1) week, but in no case less than 72 hours, in advance of the evaluation. Examples of special equipment include spot photometers, flight control measurement devices, and sound analyzers. Examples of specially qualified personnel include individuals specifically qualified to install or use any special equipment when its use is required.

b. Examples of a special evaluation include an evaluation conducted after an FFS is moved, at the request of the TPAA, or as a result of comments received from users of the FFS that raise questions about the continued qualification or use of the FFS.

End Information

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11. Initial (and Upgrade) Qualification Requirements (§ 60.15)

Begin QPS Requirements

a. In order to be qualified at a particular qualification level, the FFS must:

(1) Meet the general requirements listed in Attachment 1;

(2) Meet the objective testing requirements listed in Attachment 2; and

(3) Satisfactorily accomplish the subjective tests listed in Attachment 3.

b. The request described in § 60.15(a) must include all of the following:

(1) A statement that the FFS meets all of the applicable provisions of this part and all applicable provisions of the QPS.

(2) A confirmation that the sponsor will forward to the NSPM the statement described in § 60.15(b) in such time as to be received no later than 5 business days prior to the scheduled evaluation and may be forwarded to the NSPM via traditional or electronic means.

(3) A qualification test guide (QTG), acceptable to the NSPM, that includes all of the following:

(a) Objective data obtained from aircraft testing or another approved source.

(bi) Correlating objective test results obtained from the performance of the FFS as prescribed in the appropriate QPS.

(c) The result of FFS subjective tests prescribed in the appropriate QPS.

(d) A description of the equipment necessary to perform the evaluation for initial qualification and the continuing qualification evaluations.

c. The QTG described in paragraph (a)(3) of this section, must provide the documented proof of compliance with the simulator objective tests in Attachment 2, Table A2A of this appendix.

d. The QTG is prepared and submitted by the sponsor, or the sponsor's agent on behalf of the sponsor, to the NSPM for review and approval, and must include, for each objective test:

(1) Parameters, tolerances, and flight conditions;

(2) Pertinent and complete instructions for the conduct of automatic and manual tests;

(3) A means of comparing the FFS test results to the objective data;

(4) Any other information as necessary, to assist in the evaluation of the test results;

(5) Other information appropriate to the qualification level of the FFS.

e. The QTG described in paragraphs (a)(3) and (b) of this section, must include the following:

(1) A QTG cover page with sponsor and FAA approval signature blocks (see Attachment 4, Figure A4C, for a sample QTG cover page).

(2) A continuing qualification evaluation requirements page. This page will be used by the NSPM to establish and record the frequency with which continuing qualification evaluations must be conducted and any subsequent changes that may be determined by the NSPM in accordance with § 60.19. See Attachment 4, Figure A4G, for a sample Continuing Qualification Evaluation Requirements page.

(3) An FFS information page that provides the information listed in this paragraph (see Attachment 4, Figure A4B, for a sample FFS information page). For convertible FFSs, the sponsor must submit a separate page for each configuration of the FFS.

(a) The sponsor's FFS identification number or code.

(b) The airplane model and series being simulated.

(c) The aerodynamic data revision number or reference.

(d) The source of the basic aerodynamic model and the aerodynamic coefficient data used to modify the basic model.

(e) The engine model(s) and its data revision number or reference.

(f) The flight control data revision number or reference.

(g) The flight management system identification and revision level.

(h) The FFS model and manufacturer.

(i) The date of FFS manufacture.

(j) The FFS computer identification.

(k) The visual system model and manufacturer, including display type.

(l) The motion system type and manufacturer, including degrees of freedom.

(4) A Table of Contents.

(5) A log of revisions and a list of effective pages.

(6) A list of all relevant data references.

(7) A glossary of terms and symbols used (including sign conventions and units).

(8) Statements of compliance and capability (SOCs) with certain requirements. SOCs must provide references to the sources of information that show the capability of the FFS to comply with the requirement, a rationale explaining how the referenced material is used, mathematical equations and parameter values used, and the conclusions reached; i.e., that the FFS complies with the requirement.

(9) Recording procedures or equipment required to accomplish the objective tests.

(10) The following information for each objective test designated in Attachment 2, Table A2A, as applicable to the qualification level sought:

(a) Name of the test.

(b) Objective of the test.

(c) Initial conditions.

(d) Manual test procedures.

(e) Automatic test procedures (if applicable).

(f) Method for evaluating FFS objective test results.

(g) List of all relevant parameters driven or constrained during the automatically conducted test(s).

(h) List of all relevant parameters driven or constrained during the manually conducted test(s).

(i) Tolerances for relevant parameters.

(j) Source of Validation Data (document and page number).

(k) Copy of the Validation Data (if located in a separate binder, a cross reference for the identification and page number for pertinent data location must be provided).

(l) Simulator Objective Test Results as obtained by the sponsor. Each test result must reflect the date completed and must be clearly labeled as a product of the device being tested.

f. A convertible FFS is addressed as a separate FFS for each model and series airplane to which it will be converted and for the FAA qualification level sought. If a sponsor seeks qualification for two or more models of an airplane type using a convertible FFS, the sponsor must submit a QTG for each airplane model, or a QTG for the first airplane model and a supplement to that QTG for each additional airplane model. The NSPM will conduct evaluations for each airplane model.

g. Form and manner of presentation of objective test results in the QTG:

(1) The sponsor's FFS test results must be recorded in a manner acceptable to the NSPM, that allows easy comparison of the FFS test results to the validation data (e.g., use of a multi-channel recorder, line printer, cross plotting, overlays, transparencies).

(2) FFS results must be labeled using terminology common to airplane parameters as opposed to computer software identifications.

(3) Validation data documents included in a QTG may be photographically reduced only if such reduction will not alter the graphic scaling or cause difficulties in scale interpretation or resolution.

(4) Scaling on graphical presentations must provide the resolution necessary to evaluate the parameters shown in Attachment 2, Table A2A of this appendix.

(5) Tests involving time histories, data sheets (or transparencies thereof) and FFS test results must be clearly marked with appropriate reference points to ensure an accurate comparison between the FFS and the airplane with respect to time. Time histories recorded via a line printer are to be clearly identified for cross plotting on the airplane data. Over-plots must not obscure the reference data.

h. The sponsor may elect to complete the QTG objective and subjective tests at the manufacturer's facility or at the sponsor's training facility. If the tests are conducted at the manufacturer's facility, the sponsor must repeat at least one-third of the tests at the sponsor's training facility in order to substantiate FFS performance. The QTG must be clearly annotated to indicate when and where each test was accomplished. Tests conducted at the manufacturer's facility and at the sponsor's training facility must be conducted after the FFS is assembled with systems and sub-systems functional and operating in an interactive manner. The test results must be submitted to the NSPM.

i. The sponsor must maintain a copy of the MQTG at the FFS location.

j. All FFSs for which the initial qualification is conducted after May 30, 2014, must have an electronic MQTG (eMQTG) including all objective data obtained from airplane testing, or another approved source (reformatted or digitized), together with correlating objective test results obtained from the performance of the FFS (reformatted or digitized) as prescribed in this appendix. The eMQTG must also contain the general FFS performance or demonstration results (reformatted or digitized) prescribed in this appendix, and a description of the equipment necessary to perform the initial qualification evaluation and the continuing qualification evaluations. The eMQTG must include the original validation data used to validate FFS performance and handling qualities in either the original digitized format from the data supplier or an electronic scan of the original time-history plots that were provided by the data supplier. A copy of the eMQTG must be provided to the NSPM.

k. All other FFSs not covered in subparagraph ''j'' must have an electronic copy of the MQTG by May 30, 2014. A copy of the eMQTG must be provided to the NSPM. This may be provided by an electronic scan presented in a Portable Document File (PDF), or similar format acceptable to the NSPM.

l. During the initial (or upgrade) qualification evaluation conducted by the NSPM, the sponsor must also provide a person who is a user of the device (e.g., a qualified pilot or instructor pilot with flight time experience in that aircraft) and knowledgeable about the operation of the aircraft and the operation of the FFS.

End QPS Requirements

Begin Information

m. Only those FFSs that are sponsored by a certificate holder as defined in Appendix F will be evaluated by the NSPM. However, other FFS evaluations may be conducted on a case-by-case basis as the Administrator deems appropriate, but only in accordance with applicable agreements.

n. The NSPM will conduct an evaluation for each configuration, and each FFS must be evaluated as completely as possible. To ensure a thorough and uniform evaluation, each FFS is subjected to the general simulator requirements in Attachment 1, the objective tests listed in Attachment 2, and the subjective tests listed in Attachment 3 of this appendix. The evaluations described herein will include, but not necessarily be limited to the following:

(1) Airplane responses, including longitudinal and lateral-directional control responses (see Attachment 2 of this appendix);

(2) Performance in authorized portions of the simulated airplane's operating envelope, to include tasks evaluated by the NSPM in the areas of surface operations, takeoff, climb, cruise, descent, approach, and landing as well as abnormal and emergency operations (see Attachment 2 of this appendix);

(3) Control checks (see Attachment 1 and Attachment 2 of this appendix);

(4) Flight deck configuration (see Attachment 1 of this appendix);

(5) Pilot, flight engineer, and instructor station functions checks (see Attachment 1 and Attachment 3 of this appendix);

(6) Airplane systems and sub-systems (as appropriate) as compared to the airplane simulated (see Attachment 1 and Attachment 3 of this appendix);

(7) FFS systems and sub-systems, including force cueing (motion), visual, and aural (sound) systems, as appropriate (see Attachment 1 and Attachment 2 of this appendix); and

(8) Certain additional requirements, depending upon the qualification level sought, including equipment or circumstances that may become hazardous to the occupants. The sponsor may be subject to Occupational Safety and Health Administration requirements.

o. The NSPM administers the objective and subjective tests, which includes an examination of functions. The tests include a qualitative assessment of the FFS by an NSP pilot. The NSP evaluation team leader may assign other qualified personnel to assist in accomplishing the functions examination and/or the objective and subjective tests performed during an evaluation when required.

(1) Objective tests provide a basis for measuring and evaluating FFS performance and determining compliance with the requirements of this part.

(2) Subjective tests provide a basis for:

(a) Evaluating the capability of the FFS to perform over a typical utilization period;

(b) Determining that the FFS satisfactorily simulates each required task;

(c) Verifying correct operation of the FFS controls, instruments, and systems; and

(d) Demonstrating compliance with the requirements of this part.

p. The tolerances for the test parameters listed in Attachment 2 of this appendix reflect the range of tolerances acceptable to the NSPM for FFS validation and are not to be confused with design tolerances specified for FFS manufacture. In making decisions regarding tests and test results, the NSPM relies on the use of operational and engineering judgment in the application of data (including consideration of the way in which the flight test was flown and way the data was gathered and applied) data presentations, and the applicable tolerances for each test.

q. In addition to the scheduled continuing qualification evaluation, each FFS is subject to evaluations conducted by the NSPM at any time without prior notification to the sponsor. Such evaluations would be accomplished in a normal manner (i.e., requiring exclusive use of the FFS for the conduct of objective and subjective tests and an examination of functions) if the FFS is not being used for flight crewmember training, testing, or checking. However, if the FFS were being used, the evaluation would be conducted in a non-exclusive manner. This non-exclusive evaluation will be conducted by the FFS evaluator accompanying the check airman, instructor, Aircrew Program Designee (APD), or FAA inspector aboard the FFS along with the student(s) and observing the operation of the FFS during the training, testing, or checking activities.

r. Problems with objective test results are handled as follows:

(1) If a problem with an objective test result is detected by the NSP evaluation team during an evaluation, the test may be repeated or the QTG may be amended.

(2) If it is determined that the results of an objective test do not support the level requested but do support a lower level, the NSPM may qualify the FFS at that lower level. For example, if a Level D evaluation is requested and the FFS fails to meet sound test tolerances, it could be qualified at Level C.

s. After an FFS is successfully evaluated, the NSPM issues a Statement of Qualification (SOQ) to the sponsor. The NSPM recommends the FFS to the TPAA, who will approve the FFS for use in a flight training program. The SOQ will be issued at the satisfactory conclusion of the initial or continuing qualification evaluation and will list the tasks for which the FSTD is qualified, referencing the tasks described in Table A1B in attachment 1. However, it is the sponsor's responsibility to obtain TPAA approval prior to using the FSTD in an FAA-approved flight training program.

t. Under normal circumstances, the NSPM establishes a date for the initial or upgrade evaluation within ten (10) working days after determining that a complete QTG is acceptable. Unusual circumstances may warrant establishing an evaluation date before this determination is made. A sponsor may schedule an evaluation date as early as 6 months in advance. However, there may be a delay of 45 days or more in rescheduling and completing the evaluation if the sponsor is unable to meet the scheduled date. See Attachment 4, Figure A4A, Sample Request for Initial, Upgrade, or Reinstatement Evaluation.

u. The numbering system used for objective test results in the QTG should closely follow the numbering system set out in Attachment 2, FFS Objective Tests, Table A2A.

v. Contact the NSPM or visit the NSPM Web site for additional information regarding the preferred qualifications of pilots used to meet the requirements of § 60.15(d).

w. Examples of the exclusions for which the FFS might not have been subjectively tested by the sponsor or the NSPM and for which qualification might not be sought or granted, as described in § 60.15(g)(6), include windshear training and circling approaches.

End Information

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12. Additional Qualifications for a Currently Qualified FSTD (§ 60.16)

Begin Information

No additional regulatory or informational material applies to § 60.16, Additional Qualifications for a Currently Qualified FFS.

End Information

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13. Previously Qualified FSTDs (§ 60.17)

Begin QPS Requirements

a. In instances where a sponsor plans to remove an FFS from active status for a period of less than two years, the following procedures apply:

(1) The NSPM must be notified in writing and the notification must include an estimate of the period that the FFS will be inactive;

(2) Continuing Qualification evaluations will not be scheduled during the inactive period;

(3) The NSPM will remove the FFS from the list of qualified FSTDs on a mutually established date not later than the date on which the first missed continuing qualification evaluation would have been scheduled;

(4) Before the FFS is restored to qualified status, it must be evaluated by the NSPM. The evaluation content and the time required to accomplish the evaluation is based on the number of continuing qualification evaluations and sponsor-conducted quarterly inspections missed during the period of inactivity.

(5) The sponsor must notify the NSPM of any changes to the original scheduled time out of service;

b. Simulators qualified prior to May 30, 2008, are not required to meet the general simulation requirements, the objective test requirements or the subjective test requirements of attachments 1, 2, and 3 of this appendix as long as the simulator continues to meet the test requirements contained in the MQTG developed under the original qualification basis.

c. After [date 1 year after effective date of the final rule] each visual scene or airport model beyond the minimum required for the FSTD qualification level that is installed in and available for use in a qualified FSTD must meet the requirements described in attachment 3 of this appendix.

End QPS Requirements

Begin Information

d. Other certificate holders or persons desiring to use an FFS may contract with FFS sponsors to use FFSs previously qualified at a particular level for an airplane type and approved for use within an FAA-approved flight training program. Such FFSs are not required to undergo an additional qualification process, except as described in § 60.16.

e. Each FFS user must obtain approval from the appropriate TPAA to use any FFS in an FAA-approved flight training program.

f. The intent of the requirement listed in § 60.17(b), for each FFS to have a Statement of Qualification within 6 years, is to have the availability of that statement (including the configuration list and the limitations to authorizations) to provide a complete picture of the FFS inventory regulated by the FAA. The issuance of the statement will not require any additional evaluation or require any adjustment to the evaluation basis for the FFS.

g. Downgrading of an FFS is a permanent change in qualification level and will necessitate the issuance of a revised Statement of Qualification to reflect the revised qualification level, as appropriate. If a temporary restriction is placed on an FFS because of a missing, malfunctioning, or inoperative component or on-going repairs, the restriction is not a permanent change in qualification level. Instead, the restriction is temporary and is removed when the reason for the restriction has been resolved.

h. It is not the intent of the NSPM to discourage the improvement of existing simulation (e.g., the ''updating'' of a visual system to a newer model, or the replacement of the IOS with a more capable unit) by requiring the ''updated'' device to meet the qualification standards current at the time of the update. Depending on the extent of the update, the NSPM may require that the updated device be evaluated and may require that an evaluation include all or a portion of the elements of an initial evaluation. However, the standards against which the device would be evaluated are those that are found in the MQTG for that device.

i. The NSPM will determine the evaluation criteria for an FSTD that has been removed from active status. The criteria will be based on the number of continuing qualification evaluations and quarterly inspections missed during the period of inactivity. For example, if the FFS were out of service for a 1 year period, it would be necessary to complete the entire QTG, since all of the quarterly evaluations would have been missed. The NSPM will also consider how the FFS was stored, whether parts were removed from the FFS and whether the FFS was disassembled.

j. The FFS will normally be requalified using the FAA-approved MQTG and the criteria that was in effect prior to its removal from qualification. However, inactive periods of 2 years or more will require requalification under the standards in effect and current at the time of requalification.

End Information

14. Inspection, Continuing Qualification Evaluation, and Maintenance Requirements (§ 60.19)

Begin QPS Requirements

a. The sponsor must conduct a minimum of four evenly spaced inspections throughout the year. The objective test sequence and content of each inspection must be developed by the sponsor and must be acceptable to the NSPM.

b. The description of the functional preflight inspection must be contained in the sponsor's QMS.

c. Record ''functional preflight'' in the FFS discrepancy log book or other acceptable location, including any item found to be missing, malfunctioning, or inoperative.

d. During the continuing qualification evaluation conducted by the NSPM, the sponsor must also provide a person knowledgeable about the operation of the aircraft and the operation of the FFS.

e. The NSPM will conduct continuing qualification evaluations every 12 months unless:

(1) The NSPM becomes aware of discrepancies or performance problems with the device that warrants more frequent evaluations; or

(2) The sponsor implements a QMS that justifies less frequent evaluations. However, in no case shall the frequency of a continuing qualification evaluation exceed 36 months.

End QPS Requirements

Begin Information

f. The sponsor's test sequence and the content of each quarterly inspection required in § 60.19(a)(1) should include a balance and a mix from the objective test requirement areas listed as follows:

(1) Performance.

(2) Handling qualities.

(3) Motion system (where appropriate).

(4) Visual system (where appropriate).

(5) Sound system (where appropriate).

(6) Other FFS systems.

g. If the NSP evaluator plans to accomplish specific tests during a normal continuing qualification evaluation that requires the use of special equipment or technicians, the sponsor will be notified as far in advance of the evaluation as practical; but not less than 72 hours. Examples of such tests include latencies, control dynamics, sounds and vibrations, motion, and/or some visual system tests.

h. The continuing qualification evaluations, described in § 60.19(b), will normally require 4 hours of FFS time. However, flexibility is necessary to address abnormal situations or situations involving aircraft with additional levels of complexity (e.g., computer controlled aircraft). The sponsor should anticipate that some tests may require additional time. The continuing qualification evaluations will consist of the following:

(1) Review of the results of the quarterly inspections conducted by the sponsor since the last scheduled continuing qualification evaluation.

(2) A selection of approximately 8 to 15 objective tests from the MQTG that provide an adequate opportunity to evaluate the performance of the FFS. The tests chosen will be performed either automatically or manually and should be able to be conducted within approximately one-third (⅓) of the allotted FFS time.

(3) A subjective evaluation of the FFS to perform a representative sampling of the tasks set out in attachment 3 of this appendix. This portion of the evaluation should take approximately two-thirds (⅔) of the allotted FFS time.

(4) An examination of the functions of the FFS may include the motion system, visual system, sound system, instructor operating station, and the normal functions and simulated malfunctions of the airplane systems. This examination is normally accomplished simultaneously with the subjective evaluation requirements.

End Information

15. Logging FSTDs Discrepancies (§ 60.20)

Begin Information

No additional regulatory or informational material applies to § 60.20. Logging FFS Discrepancies.

End Information

16. Interim Qualification of FSTDs for New Airplane Types or Models (§ 60.21)

Begin Information

No additional regulatory or informational material applies to § 60.21, Interim Qualification of FFSs for New Airplane Types or Models.

End Information

17. Modifications to FSTDs (§ 60.23)

Begin QPS Requirements

a. The notification described in § 60.23(c)(2) must include a complete description of the planned modification, with a description of the operational and engineering effect the proposed modification will have on the operation of the FFS and the results that are expected with the modification incorporated.

b. Prior to using the modified FFS:

(1) All the applicable objective tests completed with the modification incorporated, including any necessary updates to the MQTG (e.g., accomplishment of FSTD Directives) must be acceptable to the NSPM; and

(2) The sponsor must provide the NSPM with a statement signed by the MR that the factors listed in § 60.15(b) are addressed by the appropriate personnel as described in that section.

End QPS Requirements

Begin Information

FSTD Directives are considered modifications of an FFS. See Attachment 4 for a sample index of effective FSTD Directives. See Attachment 6 for a list of all effective FSTD Directives applicable to Airplane FFSs.

End Information

18. Operation with Missing, Malfunctioning, or Inoperative Components (§ 60.25)

Begin Information

a. The sponsor's responsibility with respect to § 60.25(a) is satisfied when the sponsor fairly and accurately advises the user of the current status of an FFS, including any missing, malfunctioning, or inoperative (MMI) component(s).

b. If the 29th or 30th day of the 30-day period described in § 60.25(b) is on a Saturday, a Sunday, or a holiday, the FAA will extend the deadline until the next business day.

c. In accordance with the authorization described in § 60.25(b), the sponsor may develop a discrepancy prioritizing system to accomplish repairs based on the level of impact on the capability of the FFS. Repairs having a larger impact on FFS capability to provide the required training, evaluation, or flight experience will have a higher priority for repair or replacement.

End Information

19. Automatic Loss of Qualification and Procedures for Restoration of Qualification (§ 60.27)

Begin Information

If the sponsor provides a plan for how the FFS will be maintained during its out-of-service period (e.g., periodic exercise of mechanical, hydraulic, and electrical systems; routine replacement of hydraulic fluid; control of the environmental factors in which the FFS is to be maintained) there is a greater likelihood that the NSPM will be able to determine the amount of testing required for requalification.

End Information

20. Other Losses of Qualification and Procedures for Restoration of Qualification (§ 60.29)

Begin Information

If the sponsor provides a plan for how the FFS will be maintained during its out-of-service period (e.g., periodic exercise of mechanical, hydraulic, and electrical systems; routine replacement of hydraulic fluid; control of the environmental factors in which the FFS is to be maintained) there is a greater likelihood that the NSPM will be able to determine the amount of testing required for requalification.

End Information

21. Recordkeeping and Reporting (§ 60.31)

Begin QPS Requirements

a. FSTD modifications can include hardware or software changes. For FSTD modifications involving software programming changes, the record required by § 60.31(a)(2) must consist of the name of the aircraft system software, aerodynamic model, or engine model change, the date of the change, a summary of the change, and the reason for the change.

b. If a coded form for recordkeeping is used, it must provide for the preservation and retrieval of information with appropriate security or controls to prevent the inappropriate alteration of such records after the fact.

End QPS Requirements

22. Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements (§ 60.33)

Begin Information

No additional regulatory or informational material applies to § 60.33, Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements.

23. Specific Full Flight Simulator Compliance Requirements (§ 60.35)

No additional regulatory or informational material applies to § 60.35, Specific FFS Compliance Requirements.

24. [Reserved]

25. FSTD Qualification on the Basis of a Bilateral Aviation Safety Agreement (BASA) (§ 60.37)

No additional regulatory or informational material applies to § 60.37, FSTD Qualification on the Basis of a Bilateral Aviation Safety Agreement (BASA).

End Information

Attachment 1 to Appendix A to Part 60—

General Simulator Requirements

Begin QPS Requirements

1. Requirements

a. Certain requirements included in this appendix must be supported with a Statement of Compliance and Capability (SOC), which may include objective and subjective tests. The SOC will confirm that the requirement was satisfied, and describe how the requirement was met, such as gear modeling approach or coefficient of friction sources. The requirements for SOCs and tests are indicated in the ''General Simulator Requirements'' column in Table A1A of this appendix.

b. Table A1A describes the requirements for the indicated level of FFS. Many devices include operational systems or functions that exceed the requirements outlined in this section. However, all systems will be tested and evaluated in accordance with this appendix to ensure proper operation.

End QPS Requirements

Begin Information

2. Discussion

a. This attachment describes the general simulator requirements for qualifying an airplane FFS. The sponsor should also consult the objective tests in attachment 2 and the examination of functions and subjective tests listed in attachment 3 to determine the complete requirements for a specific level simulator.

b. The material contained in this attachment is divided into the following categories:

(1) General flight deck configuration.

(2) Simulator programming.

(3) Equipment operation.

(4) Equipment and facilities for instructor/evaluator functions.
(5) Motion system.
(6) Visual system.
(7) Sound system.

c. Table A1A provides the standards for the General Simulator Requirements.

d. Table A1B provides the tasks that the sponsor will examine to determine whether the FSTD satisfactorily meets the requirements for flight crew training, testing, and experience, and provides the tasks for which the simulator may be qualified.

e. Table A1C provides the functions that an instructor/check airman must be able to control in the simulator.

f. It is not required that all of the tasks that appear on the List of Qualified Tasks (part of the SOQ) be accomplished during the initial or continuing qualification evaluation.

End Information

TABLE A1A.—MINIMUM SIMULATOR REQUIREMENTS

<<<QPS requirements>>>		Simulator levels				Information
Number	General simulator requirements	A	B	C	D	Notes
1. General Flight Deck Configuration						
1.a.	The simulator must have a flight deck that is a replica of the airplane simulated with controls, equipment, observable flight deck indicators, circuit breakers, and bulkheads properly located, functionally accurate and replicating the airplane. The direction of movement of controls and switches must be identical to the airplane. Pilot seats must allow the occupant to achieve the design ''eye position'' established for the airplane being simulated. Equipment for the operation of the flight deck windows must be included, but the actual windows need not be operable. Additional equipment such as fire axes, extinguishers, and spare light bulbs must be available in the FFS but may be relocated to a suitable location as near as practical to the original position. Fire axes, landing gear pins, and any similar purpose instruments need only be represented in silhouette. An SOC is required.	X	X	X	X	For simulator purposes, the flight deck consists of all that space forward of a cross section of the flight deck at the most extreme aft setting of the pilots' seats, including additional required crewmember duty stations and those required bulkheads aft of the pilot seats. For clarification, bulkheads containing only items such as landing gear pin storage compartments, fire axes or extinguishers, spare light bulbs, and aircraft document pouches are not considered essential and may be omitted.
1.b.	Those circuit breakers that affect procedures or result in observable flight deck indications must be properly located and functionally accurate. An SOC is required.	X	X	X	X	
2. Programming						
2.a.	A flight dynamics model that accounts for various combinations of drag and thrust normally encountered in flight must correspond to actual flight conditions, including the effect of change in airplane attitude, thrust, drag, altitude, temperature, gross weight, moments of inertia, center of gravity location, and configuration. An SOC is required.	X	X	X	X	
2.b.	The simulator must have the computer capacity, accuracy, resolution, and dynamic response needed to meet the qualification level sought. An SOC is required.	X	X	X	X	
2.c.	Surface operations must be represented to the extent that allows turns within the confines of the runway and adequate controls on the landing and roll-out from a crosswind approach to a landing. A subjective test is required.	X				
2.d.	Ground handling and aerodynamic programming must include the following: A subjective test is required for each.					
2.d.1. ...	Ground effect		X	X	X	Ground effect includes modeling that accounts for roundout, flare, touchdown, lift, drag, pitching moment, trim, and power while in ground effect.

TABLE A1A.—MINIMUM SIMULATOR REQUIREMENTS—Continued

<<<QPS requirements>>>		Simulator levels				Information
Number	General simulator requirements	A	B	C	D	Notes
2.d.2. ...	Ground reaction		X	X	X	Ground reaction includes modeling that accounts for strut deflections, tire friction, and side forces. This is the reaction of the airplane upon contact with the runway during landing, and may differ with changes in factors such as gross weight, airspeed, or rate of descent on touchdown.
2.d.3. ...	Ground handling characteristics, including aerodynamic and ground reaction modeling including steering inputs, operations with crosswind, braking, thrust reversing, deceleration, and turning radius.		X	X	X	
2.e.	The simulator must employ windshear models that provide training for recognition of windshear phenomena and the execution of recovery procedures. Models must be available to the instructor/evaluator for the following critical phases of flight: (1) Prior to takeoff rotation. (2) At liftoff. (3) During initial climb. (4) On final approach, below 500 ft AGL.					
	The QTG must reference the FAA Windshear Training Aid or present alternate airplane related data, including the implementation method(s) used. If the alternate method is selected, wind models from the Royal Aerospace Establishment (RAE), the Joint Airport Weather Studies (JAWS) Project and other recognized sources may be implemented, but must be supported and properly referenced in the QTG. Only those simulators meeting these requirements may be used to satisfy the training requirements of part 121 pertaining to a certificate holder's approved low-altitude windshear flight training program as described in § 121.409. Objective tests are required for qualification; see Attachment 2 and Attachment 5 of this appendix. A subjective test is required.			X	X	If desired, Level A and B simulators may qualify for windshear training by meeting these standards; see Attachment 5 of this appendix. Windshear models may consist of independent variable winds in multiple simultaneous components. The FAA Windshear Training Aid presents one acceptable means of compliance with simulator wind model requirements.
2.f.	The simulator must provide for manual and automatic testing of simulator hardware and software programming to determine compliance with simulator objective tests as prescribed in Attachment 2. An SOC is required.			X	X	Automatic "flagging" of out-of-tolerance situations is encouraged.
2.g.	Relative responses of the motion system, visual system, and flight deck instruments, measured by latency tests or transport delay tests. Motion onset should occur before the start of the visual scene change (the start of the scan of the first video field containing different information) but must occur before the end of the scan of that video field. Instrument response may not occur prior to motion onset. Test results must be within the following limits.					The intent is to verify that the simulator provides instrument, motion, and visual cues that are, within the stated time delays, like the airplane responses. For airplane response, acceleration in the appropriate, corresponding rotational axis is preferred.
2.g.1. ...	300 milliseconds of the airplane response.	X	X			
	Objective Tests are required.					
2.g.2. ...	150 milliseconds of the airplane response. Objective Tests are required.			X	X	

TABLE A1A.—MINIMUM SIMULATOR REQUIREMENTS—Continued

<<<QPS requirements>>>		Simulator levels				Information
Number	General simulator requirements	A	B	C	D	Notes
2.h.	The simulator must accurately reproduce the following runway conditions: (1) Dry. (2) Wet. (3) Icy. (4) Patchy Wet. (5) Patchy Icy. (6) Wet on Rubber Residue in Touchdown Zone.					
	An SOC is required.					
	Objective tests are required only for dry, wet, and icy runway conditions; see Attachment 2.					
	Subjective tests are required for patchy wet, patchy icy, and wet on rubber residue in touchdown zone conditions; see Attachment 3.			X	X	
2.i.	The simulator must simulate: (1) Brake and tire failure dynamics, including anti-skid failure. (2) Decreased brake efficiency due to high brake temperatures, if applicable. An SOC is required.			X	X	Simulator pitch, side loading, and directional control characteristics should be representative of the airplane.
2.j.	The simulator must replicate the effects of airframe and engine icing. A Subjective Test is required.			X	X	
2.k.	The aerodynamic modeling in the simulator must include: (1) Low-altitude level-flight ground effect; (2) Mach effect at high altitude; (3) Normal and reverse dynamic thrust effect on control surfaces; (4) Aeroelastic representations; and (5) Nonlinearities due to sideslip. An SOC is required and must include references to computations of aeroelastic representations and of nonlinearities due to sideslip.				X	See Attachment 2, paragraph 4, for further information on ground effect.
2.l.	The simulator must have aerodynamic and ground reaction modeling for the effects of reverse thrust on directional control, if applicable. An SOC is required.		X	X	X	
3. Equipment Operation						
3.a.	All relevant instrument indications involved in the simulation of the airplane must automatically respond to control movement or external disturbances to the simulated airplane; e.g., turbulence or windshear. Numerical values must be presented in the appropriate units. A subjective test is required.	X	X	X	X	
3.b.	Communications, navigation, caution, and warning equipment must be installed and operate within the tolerances applicable for the airplane. A subjective test is required.	X	X	X	X	See Attachment 3 for further information regarding long-range navigation equipment.
3.c.	Simulated airplane systems must operate as the airplane systems operate under normal, abnormal, and emergency operating conditions on the ground and in flight. A subjective test is required.	X	X	X	X	

TABLE A1A.—MINIMUM SIMULATOR REQUIREMENTS—Continued

<<<QPS requirements>>>		Simulator levels				Information
Number	General simulator requirements	A	B	C	D	Notes
3.d.	The simulator must provide pilot controls with control forces and control travel that correspond to the simulated airplane. The simulator must also react in the same manner as in the airplane under the same flight conditions. A objective test is required.	X	X	X	X	
3.e.	Simulator control feel dynamics must replicate the airplane. This must be determined by comparing a recording of the control feel dynamics of the simulator to airplane measurements. For initial and upgrade qualification evaluations, the control dynamic characteristics must be measured and recorded directly from the flight deck controls, and must be accomplished in takeoff, cruise, and landing flight conditions and configurations. Objective tests are required.			X	X	
4. Instructor or Evaluator Facilities						
4.a.	In addition to the flight crewmember stations, the simulator must have at least two suitable seats for the instructor/check airman and FAA inspector. These seats must provide adequate vision to the pilot's panel and forward windows. All seats other than flight crew seats need not represent those found in the airplane, but must be adequately secured to the floor and equipped with similar positive restraint devices. A subjective test is required.	X	X	X	X	The NSPM will consider alternatives to this standard for additional seats based on unique flight deck configurations.
4.b.	The simulator must have controls that enable the instructor/evaluator to control all required system variables and insert all abnormal or emergency conditions into the simulated airplane systems as described in the sponsor's FAA-approved training program; or as described in the relevant operating manual as appropriate. A subjective test is required.	X	X	X	X	
4.c.	The simulator must have instructor controls for environmental conditions including wind speed and direction. A subjective test is required.	X	X	X	X	
4.d.	The simulator must provide the instructor or evaluator the ability to present ground and air hazards. A subjective test is required.			X	X	For example, another airplane crossing the active runway or converging airborne traffic.
5. Motion System						
5.a.	The simulator must have motion (force) cues perceptible to the pilot that are representative of the motion in an airplane. A subjective test is required.	X	X	X	X	For example, touchdown cues should be a function of the rate of descent (RoD) of the simulated airplane.
5.b.	The simulator must have a motion (force cueing) system with a minimum of three degrees of freedom (at least pitch, roll, and heave). An SOC is required.	X	X			
5.c.	The simulator must have a motion (force cueing) system that produces cues at least equivalent to those of a six-degrees-of-freedom, synergistic platform motion system (i.e., pitch, roll, yaw, heave, sway, and surge). An SOC is required.			X	X	
5.d.	The simulator must provide for the recording of the motion system response time. An SOC is required.	X	X	X	X	

TABLE A1A.—MINIMUM SIMULATOR REQUIREMENTS—Continued

<<<QPS requirements>>>		Simulator levels				Information
Number	General simulator requirements	A	B	C	D	Notes
5.e.	The simulator must provide motion effects programming to include: (1) Thrust effect with brakes set. (2) Runway rumble, oleo deflections, effects of ground speed, uneven runway, centerline lights, and taxiway characteristics. (3) Buffets on the ground due to spoiler/speedbrake extension and thrust reversal. (4) Bumps associated with the landing gear. (5) Buffet during extension and retraction of landing gear. (6) Buffet in the air due to flap and spoiler/speedbrake extension. (7) Approach-to-Stall buffet. (8) Representative touchdown cues for main and nose gear. (9) Nosewheel scuffing, if applicable. (10) Mach and maneuver buffet.		X	X	X	
	A subjective test is required.					
5.f.	The simulator must provide characteristic motion vibrations that result from operation of the airplane if the vibration marks an event or airplane state that can be sensed in the flight deck. An objective test is required.				X	The simulator should be programmed and instrumented in such a manner that the characteristic buffet modes can be measured and compared to airplane data.
6. Visual System						
6.a.	The simulator must have a visual system providing an out-of-the-flight deck view. A subjective test is required.	X	X	X	X	
6.b.	The simulator must provide a continuous collimated field of view of at least 45° horizontally and 30° vertically per pilot seat or the number of degrees necessary to meet the visual ground segment requirement, whichever is greater. Both pilot seat visual systems must be operable simultaneously. The minimum horizontal field of view coverage must be plus and minus one-half (½) of the minimum continuous field of view requirement, centered on the zero degree azimuth line relative to the aircraft fuselage. Additional field of view capability may be added at the sponsor's discretion provided the minimum fields of view are retained. An SOC must explain the geometry of the installation. An SOC is required.	X	X			
6.c.	(Reserved)					
6.d.	The simulator must provide a continuous collimated visual field of view of at least 176° horizontally and 36° vertically or the number of degrees necessary to meet the visual ground segment requirement, whichever is greater. The minimum horizontal field of view coverage must be plus and minus one-half (½) of the minimum continuous field of view requirement, centered on the zero degree azimuth line relative to the aircraft fuselage. Additional field of view capability may be added at the sponsor's discretion provided the minimum fields of view are retained. An SOC must explain the geometry of the installation. An SOC is required.			X	X	The horizontal field of view is traditionally described as a 180° field of view. However, the field of view is technically no less than 176°.

TABLE A1A.—MINIMUM SIMULATOR REQUIREMENTS—Continued

<<<QPS requirements>>>		Simulator levels				Information
Number	General simulator requirements	A	B	C	D	Notes
6.e.	The visual system must be free from optical discontinuities and artifacts that create non-realistic cues. A subjective test is required.	X	X	X	X	Non-realistic cues might include image ''swimming'' and image ''roll-off,'' that may lead a pilot to make incorrect assessments of speed, acceleration, or situational awareness.
6.f.	The simulator must have operational landing lights for night scenes. Where used, dusk (or twilight) scenes require operational landing lights. A subjective test is required.	X	X	X	X	
6.g.	The simulator must have instructor controls for the following: (1) Visibility in statute miles (km) and runway visual range (RVR) in ft.(m). (2) Airport selection. (3) Airport lighting.					
	A subjective test is required.	X	X	X	X	
6.h.	The simulator must provide visual system compatibility with dynamic response programming. A subjective test is required.	X	X	X	X	
6.i.	The simulator must show that the segment of the ground visible from the simulator flight deck is the same as from the airplane flight deck (within established tolerances) when at the correct airspeed, in the landing configuration, at a main wheel height of 100 feet (30 meters) above the touchdown zone, and with visibility of 1,200 ft (350 m) RVR. An SOC is required. An objective test is required.	X	X	X	X	This will show the modeling accuracy of RVR, glideslope, and localizer for a given weight, configuration, and speed within the airplane's operational envelope for a normal approach and landing.
6.j.	The simulator must provide visual cues necessary to assess sink rates (provide depth perception) during takeoffs and landings, to include: (1) Surface on runways, taxiways, and ramps. (2) Terrain features. A subjective test is required.		X	X	X	
6.k.	The simulator must provide for accurate portrayal of the visual environment relating to the simulator attitude. A subjective test is required.	X	X	X	X	Visual attitude vs. simulator attitude is a comparison of pitch and roll of the horizon as displayed in the visual scene compared to the display on the attitude indicator.
6.l.	The simulator must provide for quick confirmation of visual system color, RVR, focus, and intensity. An SOC is required. A subjective test is required.			X	X	
6.m.	The simulator must be capable of producing at least 10 levels of occulting. A subjective test is required.			X	X	
6.n.	Night Visual Scenes. When used in training, testing, or checking activities, the simulator must provide night visual scenes with sufficient scene content to recognize the airport, the terrain, and major landmarks around the airport. The scene content must allow a pilot to successfully accomplish a visual landing. Scenes must include a definable horizon and typical terrain characteristics such as fields, roads and bodies of water and surfaces illuminated by airplane landing lights. A subjective test is required.	X	X	X	X	

TABLE A1A.—MINIMUM SIMULATOR REQUIREMENTS—Continued

<<<QPS requirements>>>		Simulator levels				Information
Number	General simulator requirements	A	B	C	D	Notes
6.o.	Dusk (or Twilight) Visual Scenes. When used in training, testing, or checking activities, the simulator must provide dusk (or twilight) visual scenes with sufficient scene content to recognize the airport, the terrain, and major landmarks around the airport. The scene content must allow a pilot to successfully accomplish a visual landing. Dusk (or twilight) scenes, as a minimum, must provide full color presentations of reduced ambient intensity, sufficient surfaces with appropriate textural cues that include self-illuminated objects such as road networks, ramp lighting and airport signage, to conduct a visual approach, landing and airport movement (taxi). Scenes must include a definable horizon and typical terrain characteristics such as fields, roads and bodies of water and surfaces illuminated by airplane landing lights. If provided, directional horizon lighting must have correct orientation and be consistent with surface shading effects. Total night or dusk (twilight) scene content must be comparable in detail to that produced by 10,000 visible textured surfaces and 15,000 visible lights with sufficient system capacity to display 16 simultaneously moving objects. An SOC is required. A subjective test is required.			X	X	
6.p.	Daylight Visual Scenes. The simulator must provide daylight visual scenes with sufficient scene content to recognize the airport, the terrain, and major landmarks around the airport. The scene content must allow a pilot to successfully accomplish a visual landing. Any ambient lighting must not ''washout'' the displayed visual scene. Total daylight scene content must be comparable in detail to that produced by 10,000 visible textured surfaces and 6,000 visible lights with sufficient system capacity to display 16 simultaneously moving objects. The visual display must be free of apparent quantization and other distracting visual effects while the simulator is in motion.				X	Brightness capability may be demonstrated with a test pattern of white light using a spot photometer.
	Note: These requirements are mandatory for level D, and applicable to any level of simulator equipped with a ''daylight'' visual system.					
	An SOC is required.					
	A subjective test is required.					
6.q.	The simulator must provide operational visual scenes that portray physical relationships known to cause landing illusions to pilots.				X	For example: short runways, landing approaches over water, uphill or downhill runways, rising terrain on the approach path, unique topographic features.
	A subjective test is required.					
6.r.	The simulator must provide special weather representations of light, medium, and heavy precipitation near a thunderstorm on takeoff and during approach and landing. Representations need only be presented at and below an altitude of 2,000 ft. (610 m) above the airport surface and within 10 miles (16 km) of the airport.				X	
	A subjective test is required.					
6.s.	The simulator must present visual scenes of wet and snow-covered runways, including runway lighting reflections for wet conditions, partially obscured lights for snow conditions, or suitable alternative effects.				X	

TABLE A1A.—MINIMUM SIMULATOR REQUIREMENTS—Continued

<<<QPS requirements>>>		Simulator levels				Information
Number	General simulator requirements	A	B	C	D	Notes
	A subjective test is required.					
6.t.	The simulator must present realistic color and directionality of all airport lighting.				X	
	A subjective test is required.					
7. Sound System						
7.a.	The simulator must provide flight deck sounds that result from pilot actions that correspond to those that occur in the airplane.	X	X	X	X	
7.b.	Volume control, if installed, must have an indication of the sound level setting.	X	X	X	X	
7.c.	The simulator must accurately simulate the sound of precipitation, windshield wipers, and other significant airplane noises perceptible to the pilot during normal operations, and include the sound of a crash (when the simulator is landed in an unusual attitude or in excess of the structural gear limitations); normal engine and thrust reversal sounds; and the sounds of flap, gear, and spoiler extension and retraction.			X	X	
	An SOC is required.					
	A subjective test is required.					
7.d.	The simulator must provide realistic amplitude and frequency of flight deck noises and sounds. Simulator performance must be recorded, compared to amplitude and frequency of the same sounds recorded in the airplane, and be made a part of the QTG.				X	
	Objective tests are required.					

TABLE A1B.—TABLE OF TASKS VS. SIMULATOR LEVEL

<<<QPS requirements>>>						<<Information>>
Number	Subjective requirements In order to be qualified at the simulator qualification level indicated, the simulator must be able to perform at least the tasks associated with that level of qualification.	Simulator levels				Notes
		A	B	C	D	
1. Preflight Procedures						
1.a.	Preflight Inspection (flight deck only)	X	X	X	X	
1.b.	Engine Start	X	X	X	X	
1.c.	Taxiing			X	X	
1.d.	Pre-takeoff Checks	X	X	X	X	
2. Takeoff and Departure Phase						
2.a.	Normal and Crosswind Takeoff			X	X	
2.b.	Instrument Takeoff	X	X	X	X	
2.c.	Engine Failure During Takeoff	A	X	X	X	
2.d.	Rejected Takeoff	X	X	X	X	
2.e.	Departure Procedure	X	X	X	X	
3. Inflight Maneuvers						

TABLE A1B.—TABLE OF TASKS VS. SIMULATOR LEVEL—Continued

<<<QPS requirements>>>						<<Information>>
Number	Subjective requirements In order to be qualified at the simulator qualification level indicated, the simulator must be able to perform at least the tasks associated with that level of qualification.	Simulator levels				Notes
		A	B	C	D	
3.a.	Steep Turns	X	X	X	X	
3.b.	Approaches to Stalls	X	X	X	X	
3.c.	Engine Failure—Multiengine Airplane	X	X	X	X	
3.d.	Engine Failure—Single-Engine Airplane	X	X	X	X	
3.e.	Specific Flight Characteristics incorporated into the user's FAA approved flight training program.	A	A	A	A	
3.f.	Recovery From Unusual Attitudes	X	X	X	X	Within the normal flight envelope supported by applicable simulation validation data.
4. Instrument Procedures						
4.a.	Standard Terminal Arrival/Flight Management System Arrivals Procedures	X	X	X	X	
4.b.	Holding	X	X	X	X	
4.c.	Precision Instrument.					
4.c.1.	All engines operating	X	X	X	X	e.g., Autopilot, Manual (Flt. Dir. Assisted), Manual (Raw Data).
4.c.2.	One engine inoperative	X	X	X	X	e.g., Manual (Flt. Dir. Assisted), Manual (Raw Data).
4.d.	d. Non-precision Instrument Approach	X	X	X	X	e.g., NDB, VOR, VOR/DME, VOR/TAC, RNAV, LOC, LOC/BC, ADF, and SDF.
4.e.	e. Circling Approach	X	X	X	X	Specific authorization required.
4.f.	Missed Approach.					
4.f.1.	Normal	X	X	X	X	
4.f.2.	One engine Inoperative	X	X	X	X	
5. Landings and Approaches to Landings						
5.a.	Normal and Crosswind Approaches and Landings		R	X	X	
5.b.	Landing From a Precision/Non-Precision Approach		R	X	X	
5.c.	Approach and Landing with (Simulated) Engine Failure—Multiengine Airplane.		R	X	X	
5.d.	Landing From Circling Approach		R	X	X	
5.e.	Rejected Landing	X	X	X	X	
5.f.	Landing From a No Flap or a Nonstandard Flap Configuration Approach ...		R	X	X	
6. Normal and Abnormal Procedures						
6.a.	Engine (including shutdown and restart)	X	X	X	X	
6.b.	Fuel System	X	X	X	X	
6.c.	Electrical System	X	X	X	X	
6.d.	Hydraulic System	X	X	X	X	
6.e.	Environmental and Pressurization Systems	X	X	X	X	

TABLE A1B.—TABLE OF TASKS VS. SIMULATOR LEVEL—Continued

<<<QPS requirements>>>						<<Information>>
Number	Subjective requirements In order to be qualified at the simulator qualification level indicated, the simulator must be able to perform at least the tasks associated with that level of qualification.	Simulator levels				Notes
		A	B	C	D	
6.f.	Fire Detection and Extinguisher Systems	X	X	X	X	
6.g.	Navigation and Avionics Systems	X	X	X	X	
6.h.	Automatic Flight Control System, Electronic Flight Instrument System, and Related Subsystems.	X	X	X	X	
6.i.	Flight Control Systems	X	X	X	X	
6.j.	Anti-ice and Deice Systems	X	X	X	X	
6.k.	Aircraft and Personal Emergency Equipment	X	X	X	X	
7. Emergency Procedures						
7.a.	Emergency Descent (Max. Rate)	X	X	X	X	
7.b.	Inflight Fire and Smoke Removal	X	X	X	X	
7.c.	Rapid Decompression	X	X	X	X	
7.d.	Emergency Evacuation	X	X	X	X	
8. Postflight Procedures						
8.a.	After-Landing Procedures	X	X	X	X	
8.b.	Parking and Securing	X	X	X	X	

"A"—indicates that the system, task, or procedure may be examined if the appropriate aircraft system or control is simulated in the FSTD and is working properly.
"R"—indicates that the simulator may be qualified for this task for recurrent training.
"X"—indicates that the simulator must be able to perform this task for this level of qualification.

TABLE A1C.—TABLE OF SIMULATOR SYSTEM TASKS

<<<QPS requirements>>>						<<<Information>>>
Number	Subjective requirements In order to be qualified at the simulator qualification level indicated, the simulator must be able to perform at least the tasks associated with that level of qualification.	Simulator levels				Notes
		A	B	C	D	
1. Instructor Operating Station (IOS), as appropriate						
1.a.	Power switch(es)	X	X	X	X	
1.b.	Airplane conditions	X	X	X	X	e.g., GW, CG, Fuel loading and Systems.
1.c.	Airports / Runways	X	X	X	X	e.g., Selection, Surface, Presets, Lighting controls.
1.d.	Environmental controls	X	X	X	X	e.g., Clouds, Visibility, RVR, Temp, Wind, Ice, Snow, Rain, and Windshear.
1.e.	Airplane system malfunctions (Insertion/deletion)	X	X	X	X	
1.f.	Locks, Freezes, and Repositioning	X	X	X	X	
2. Sound Controls						
2.a.	On/off/adjustment	X	X	X	X	
3. Motion/Control Loading System						
3.a.	On /off/emergency stop	X	X	X	X	
4. Observer Seats/Stations						

TABLE A1C.—TABLE OF SIMULATOR SYSTEM TASKS—Continued

<<<QPS requirements>>>						<<<Information>>>
Number	Subjective requirements In order to be qualified at the simulator qualification level indicated, the simulator must be able to perform at least the tasks associated with that level of qualification.	Simulator levels				Notes
		A	B	C	D	
4.a.	Position/Adjustment/Positive restraint system	X	X	X	X	

Attachment 2 to Appendix A to Part 60—Full Flight Simulator Objective Tests

TABLE OF CONTENTS

Begin Information

1. Introduction

a. For the purposes of this attachment, the flight conditions specified in the Flight Conditions Column of Table A2A, are defined as follows:

(1) Ground—on ground, independent of airplane configuration;

(2) Take-off—gear down with flaps/slats in any certified takeoff position;

(3) First segment climb—gear down with flaps/slats in any certified takeoff position (normally not above 50 ft AGL);

(4) Second segment climb—gear up with flaps/slats in any certified takeoff position (normally between 50 ft and 400 ft AGL);

(5) Clean—flaps/slats retracted and gear up;

(6) Cruise—clean configuration at cruise altitude and airspeed;

(7) Approach—gear up or down with flaps/slats at any normal approach position as recommended by the airplane manufacturer; and

(8) Landing—gear down with flaps/slats in any certified landing position.

b. The format for numbering the objective tests in Appendix A, Attachment 2, Table A2A, and the objective tests in Appendix B, Attachment 2, Table B2A, is identical. However, each test required for FFSs is not necessarily required for FTDs. Also, each test required for FTDs is not necessarily required for FFSs. Therefore, when a test number (or series of numbers) is not required, the term ''Reserved'' is used in the table at that location. Following this numbering format provides a degree of commonality between the two tables and substantially reduces the potential for confusion when referring to objective test numbers for either FFSs or FTDs.

c. The reader is encouraged to review the Airplane Flight Simulator Evaluation Handbook, Volumes I and II, published by the Royal Aeronautical Society, London, UK, and FAA Advisory Circulars (AC) 25–7, as may be amended, Flight Test Guide for Certification of Transport Category Airplanes, and (AC) 23–8, as may be amended, Flight Test Guide for Certification of Part 23 Airplanes, for references and examples regarding flight testing requirements and techniques.

d. If relevant winds are present in the objective data, the wind vector should be clearly noted as part of the data presentation, expressed in conventional terminology, and related to the runway being used for the test.

End Information

Begin QPS Requirements

2. Test Requirements

a. The ground and flight tests required for qualification are listed in Table of A2A, FFS Objective Tests. Computer generated simulator test results must be provided for each test except where an alternative test is specifically authorized by the NSPM. If a flight condition or operating condition is required for the test but does not apply to the airplane being simulated or to the qualification level sought, it may be disregarded (e.g., an engine out missed approach for a single-engine airplane or a maneuver using reverse thrust for an airplane without reverse thrust capability). Each test result is compared against the validation data described in § 60.13 and in this appendix. Although use of a driver program designed to automatically accomplish the tests is encouraged for all simulators and required for Level C and Level D simulators, it must be possible to conduct each test manually while recording all appropriate parameters. The results must be produced on an appropriate recording device acceptable to the NSPM and must include simulator number, date, time, conditions, tolerances, and appropriate dependent variables portrayed in comparison to the validation data. Time histories are required unless otherwise indicated in Table A2A. All results must be labeled using the tolerances and units given.

b. Table A2A in this attachment sets out the test results required, including the parameters, tolerances, and flight conditions for simulator validation. Tolerances are provided for the listed tests because mathematical modeling and acquisition and development of reference data are often inexact. All tolerances listed in the following tables are applied to simulator performance. When two tolerance values are given for a parameter, the less restrictive may be used unless otherwise indicated.

c. Certain tests included in this attachment must be supported with a Statement of Compliance and Capability (SOC). In Table A2A, requirements for SOCs are indicated in the ''Test Details'' column.

d. When operational or engineering judgment is used in making assessments for flight test data applications for simulator validity, such judgment must not be limited to a single parameter. For example, data that exhibit rapid variations of the measured parameters may require interpolations or a ''best fit'' data selection. All relevant parameters related to a given maneuver or flight condition must be provided to allow overall interpretation. When it is difficult or impossible to match simulator to airplane data throughout a time history, differences must be justified by providing a comparison of other related variables for the condition being assessed.

e. It is not acceptable to program the FFS so that the mathematical modeling is correct only at the validation test points. Unless otherwise noted, simulator tests must represent airplane performance and handling qualities at operating weights and centers of gravity (CG) typical of normal operation. If a test is supported by airplane data at one extreme weight or CG, another test supported by airplane data at mid-conditions or as close as possible to the other extreme must be included. Certain tests that are relevant only at one extreme CG or weight condition need not be repeated at the other extreme. Tests of handling qualities must include validation of augmentation devices.

f. When comparing the parameters listed to those of the airplane, sufficient data must also be provided to verify the correct flight condition and airplane configuration changes. For example, to show that control force is within the parameters for a static stability test, data to show the correct airspeed, power, thrust or torque, airplane configuration, altitude, and other appropriate datum identification parameters must also be given. If comparing short period dynamics, normal acceleration may be used to establish a match to the airplane, but airspeed, altitude, control input, airplane configuration, and other appropriate data must also be given. If comparing landing gear change dynamics, pitch, airspeed, and altitude may be used to establish a match to the airplane, but landing gear position must also be provided. All airspeed values must be properly annotated (e.g., indicated versus calibrated). In addition, the same variables must be used for comparison (e.g., compare inches to inches rather than inches to centimeters).

g. The QTG provided by the sponsor must clearly describe how the simulator will be set up and operated for each test. Each simulator subsystem may be tested independently, but overall integrated testing of the simulator must be accomplished to assure that the total simulator system meets the prescribed standards. A manual test procedure with explicit and detailed steps for completing each test must also be provided.

h. For previously qualified simulators, the tests and tolerances of this attachment may be used in subsequent continuing qualification evaluations for any given test if the sponsor has submitted a proposed MQTG revision to the NSPM and has received NSPM approval.

i. Simulators are evaluated and qualified with an engine model simulating the airplane data supplier's flight test engine. For qualification of alternative engine models (either variations of the flight test engines or other manufacturers' engines) additional tests with the alternative engine models may be required. This Attachment contains guidelines for alternative engines.

j. For testing Computer Controlled Airplane (CCA) simulators, or other highly augmented airplane simulators, flight test data is required for the Normal (N) and/or Non-normal (NN) control states, as indicated in this Attachment. Where test results are independent of control state, Normal or Non-normal control data may be used. All tests in Table A2A require test results in the Normal control state unless specifically noted otherwise in the Test Details section following the CCA designation. The NSPM will determine what tests are appropriate for airplane simulation data. When making this determination, the NSPM may require other levels of control state degradation for specific airplane tests. Where Non-normal control states are required, test data must be provided for one or more Non-normal control states, and must include the least augmented state. Where applicable, flight test data must record Normal and Non-normal states for:

(1) Pilot controller deflections or electronically generated inputs, including location of input; and

(2) Flight control surface positions unless test results are not affected by, or are independent of, surface positions.

k. Tests of handling qualities must include validation of augmentation devices. FFSs for highly augmented airplanes will be validated both in the unaugmented configuration (or failure state with the maximum permitted degradation in handling qualities) and the augmented configuration. Where various levels of handling qualities result from failure states, validation of the effect of the failure is necessary. Requirements for testing will be mutually agreed to between the sponsor and the NSPM on a case-by-case basis.

l. Some tests will not be required for airplanes using airplane hardware in the simulator flight deck (e.g., ''side stick controller''). These exceptions are noted in Section 2 ''Handling Qualities'' in Table A2A of this attachment. However, in these cases, the sponsor must provide a statement that the airplane hardware meets the appropriate manufacturer's specifications and the sponsor must have supporting information to that fact available for NSPM review.

m. For objective test purposes, ''Near maximum'' gross weight is a weight chosen by the sponsor or data provider that is not less than the basic operating weight (BOW) of the airplane being simulated plus 80% of the difference between the maximum certificated gross weight (either takeoff weight or landing weight, as appropriate for the test) and the BOW. ''Light'' gross weight is a weight chosen by the sponsor or data provider that is not more than 120% of the BOW of the airplane being simulated or as limited by the minimum practical operating weight of the test airplane. ''Medium'' gross weight is a weight chosen by the sponsor or data provider that is within 10 percent of the average of the numerical values of the BOW and the maximum certificated gross weight. (**Note:** BOW is the empty weight of the aircraft plus the weight of the following: normal oil quantity; lavatory servicing fluid; potable water; required crewmembers and their baggage; and emergency equipment. (References: Advisory Circular 120–27, ''Aircraft Weight and Balance;'' and FAA–H–8083–1, ''Aircraft Weight and Balance Handbook.'')

n. In those cases where the objective test results authorize a ''snapshot test'' or a ''series of snapshot tests'' results in lieu of a time-history result, the sponsor or other data provider must ensure that a steady state condition exists at the instant of time captured by the ''snapshot.'' The steady state condition must exist from 4 seconds prior to, through 1 second following, the instant of time captured by the snapshot.

End QPS Requirements

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
1. Performance									
1.a.	Taxi								
1.a.1.	Minimum Radius Turn	±3 ft (0.9 m) or 20% of airplane turn radius.	Ground	Record both Main and Nose gear turning radius. This test is to be accomplished without the use of brakes and only minimum thrust, except for airplanes requiring asymmetric thrust or braking to turn.		X	X	X	

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
1.a.2.	Rate of Turn vs. Nosewheel Steering Angle (NWA).	±10% or ±2°/sec. turn rate.	Ground	Record a minimum of two speeds, greater than minimum turning radius speed, with a spread of at least 5 knots groundspeed.		X	X	X	
1.b.	Takeoff			All commonly used takeoff flap settings are to be demonstrated at least once in the tests for minimum unstick (1.b.3.), normal takeoff (1.b.4.), critical engine failure on takeoff (1.b.5.), or crosswind takeoff (1.b.6.).					
1.b.1.	Ground Acceleration Time and Distance.	±5% time and distance or ±5% time and ±200 ft (61 m) of distance.	Takeoff	Record acceleration time and distance for a minimum of 80% of the time from brake release to V_R. Preliminary aircraft certification data may be used..	X	X	X	X	May be combined with normal takeoff (1.b.4.) or rejected takeoff (1.b.7.). Plotted data should be shown using appropriate scales for each portion of the maneuver.
1.b.2.	Minimum Control Speed—ground (V_{mcg}) using aerodynamic controls only (per applicable airworthiness standard) or alternative low speed engine inoperative test to demonstrate ground control characteristics.	±25% of maximum airplane lateral deviation or ±5 ft (1.5 m). Additionally, for those simulators of airplanes with reversible flight control systems: Rudder pedal force; ±10% or ±5 lb (2.2 daN).	Takeoff	Engine failure speed must be within ±1 knot of airplane engine failure speed. Engine thrust decay must be that resulting from the mathematical model for the engine variant applicable to the full flight simulator under test. If the modeled engine is not the same as the airplane manufacturer's flight test engine, a further test may be run with the same initial conditions using the thrust from the flight test data as the driving parameter.	X	X	X	X	If a V_{mcg} test is not available an acceptable alternative is a flight test snap engine deceleration to idle at a speed between V_1 and V_1 −10 knots, followed by control of heading using aerodynamic control only. Recovery should be achieved with the main gear on the ground. To ensure only aerodynamic control is used, nosewheel steering should be disabled (i.e., castored) or the nosewheel held slightly off the ground.
1.b.3.	Minimum Unstick Speed (V_{mu}) or equivalent test to demonstrate early rotation takeoff characteristics.	±3 kts airspeed ±1.5° pitch angle.	Takeoff	Record main landing gear strut compression or equivalent air/ground signal. Record from 10 kt before start of rotation until at least 5 seconds after the occurrence of main gear lift-off.	X	X	X	X	V_{mu} is defined as the minimum speed at which the last main landing gear leaves the ground. Main landing gear strut compression or equivalent air/ground signal should be recorded. If a V_{mu} test is not available, alternative acceptable flight tests are a constant high-attitude take-off run through main gear lift-off or an early rotation take-off.

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
1.b.4.	Normal Takeoff	±3 kts airspeed ±1.5° pitch angle ±1.5° angle of attack ±20 ft (6 m) height. Additionally, for those simulators of airplanes with reversible flight control systems: Stick/Column Force; ±10% or ±5 lb (2.2 daN).	Takeoff	Record takeoff profile from brake release to at least 200 ft (61 m) above ground level (AGL). If the airplane has more than one certificated takeoff configurations, a different configuration must be used for each weight. Data are required for a takeoff weight at near maximum takeoff weight with a mid-center of gravity and for a light takeoff weight with an aft center of gravity, as defined in Appendix F.	X	X	X	X	This test may be used for ground acceleration time and distance (1.b.1.). Plotted data should be shown using appropriate scales for each portion of the maneuver.
1.b.5.	Critical Engine Failure on Takeoff.	±3 kts airspeed ±1.5° pitch angle, ±1.5° angle of attack, ±20 ft (6 m) height, ±3° heading angle, ±2° bank angle, ±2° sideslip angle. Additionally, for those simulators of airplanes with reversible flight control systems: Stick/ Column Force; ±10% or ±5 lb (2.2 daN)); Wheel Force; ±10% or ±3 lb (1.3 daN); and Rudder Pedal Force; ±10% or ±5 lb (2.2 daN).	Takeoff	Record takeoff profile at near maximum takeoff weight from prior to engine failure to at least 200 ft (61 m) AGL. Engine failure speed must be within ±3 kts of airplane data.	X	X	X	X	
1.b.6.	Crosswind Takeoff	±3 kts airspeed, ±1.5° pitch angle, ±1.5° angle of attack, ±20 ft (6 m) height, ±2° bank angle, ±2°sideslip angle; ±3° heading angle. Correct trend at groundspeeds below 40 kts. for rudder/ pedal and heading. Additionally, for those simulators of airplanes with reversible flight control systems: Stick/Column Force; ±10% or ±5 lb (2.2 daN) stick/ column force, ±10% or ±3 lb (1.3daN) wheel force, ±10% or ±5 lb (2.2 daN) rudder pedal force.	Takeoff	Record takeoff profile from brake release to at least 200 ft (61 m) AGL. Requires test data, including information on wind profile for a crosswind component of at least 60% of the maximum wind measured at 33 ft (10 m) above the runway.	X	X	X	X	In those situations where a maximum crosswind or a maximum demonstrated crosswind is not known, contact the NSPM.

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
1.b.7.	Rejected Takeoff	±5% time or ±1.5 sec ±7.5% distance or ±250 ft (±76 m).	Takeoff	Record time and distance from brake release to full stop. Speed for initiation of the reject must be at least 80% of V_1 speed. The airplane must be at or near the maximum takeoff gross weight. Use maximum braking effort, auto or manual.	X	X	X	X	Autobrakes will be used where applicable.
1.b.8.	Dynamic Engine Failure After Takeoff.	±20% or ±2°/sec body angular rates.	Takeoff	Engine failure speed must be within ±3 Kts of airplane data. Record Hands Off from 5 secs. before to at least 5 secs. after engine failure or 30° Bank, whichever occurs first. Engine failure may be a snap deceleration to idle. (**CCA:** Test in Normal and Non-normal control state.)			X	X	For safety considerations, airplane flight test may be performed out of ground effect at a safe altitude, but with correct airplane configuration and airspeed.
1.c.	Climb								
1.c.1.	Normal Climb, all engines operating.	±3 kts airspeed, ±5% or ±100 FPM (0.5 m/Sec.) climb rate.	Clean	Flight test data is preferred, however, airplane performance manual data is an acceptable alternative. Record at nominal climb speed and mid-initial climb altitude. Flight simulator performance must be recorded over an interval of at least 1,000 ft. (300 m).	X	X	X	X	
1.c.2.	One engine Inoperative	±3 kts airspeed, ±5% or ±100 FPM (0.5 m/Sec.) climb rate, but not less than the climb gradient requirements of 14 CFR part 23 or part 25, as appropriate.	For part 23 airplanes, in accordance with part 23. For part 25 airplanes, Second Segment Climb.	Flight test data is preferred, however, airplane performance manual data is an acceptable alternative. Test at weight, altitude, or temperature limiting conditions. Record at nominal climb speed. Flight simulator performance must be recorded over an interval of at least 1,000 ft. (300 m).	X	X	X	X	
1.c.3.	One Engine Inoperative En route Climb.	±10% time, ±10% distance, ±10% fuel used.	Clean	Record results for at least a 5,000 ft (1550 m) climb segment. Flight test data or airplane performance manual data may be used.			X	X	

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
1.c.4.	One Engine Inoperative Approach Climb (if operations in icing conditions are authorized).	±3 kts airspeed, ±5% or ±100 FPM (0.5 m/Sec.) climb rate, but not less than the climb gradient requirements of 14 CFR parts 23 or 25 climb gradient, as appropriate.	Approach	Record results at near maximum gross landing weight as defined in Appendix F. Flight test data or airplane performance manual data may be used. Flight simulator performance must be recorded over an interval of at least 1,000 ft. (300 m).	X	X	X	X	The airplane should be configured with all anti-ice and de-ice systems operating normally, with the gear up and go-around flaps set. All icing accountability considerations should be applied in accordance with the aircraft certification or authorization for an approach in icing conditions.
1.d.	Cruise/Descent								
1.d.1.	Level flight acceleration.	±5% Time	Cruise	Record results for a minimum of 50 kts speed increase using maximum continuous thrust rating or equivalent.	X	X	X	X	
1.d.2.	Level flight deceleration.	±5% Time	Cruise	Record results for a minimum of 50 kts. speed decrease using idle power.	X	X	X	X	
1.d.3.	Cruise performance	±0.05 EPR or ±5% of N_1, or ±5% of Torque, ±5% of fuel flow.	Cruise	May be a single snapshot showing instantaneous fuel flow or a minimum of 2 consecutive snapshots with a spread of at least 3 minutes in steady flight.			X	X	
1.d.4.	Idle descent	±3 kt airspeed, ±5% or ±200 ft/min (1.0m/sec) descent rate.	Clean	Record a stabilized, idle power descent at normal descent speed at mid-altitude. Flight simulator performance must be recorded over an interval of at least 1,000 ft. (300 m).	X	X	X	X	
1.d.5.	Emergency descent	±5 kt airspeed, ±5% or ±300 ft/min (1.5m/s) descent rate.	N/A	Performance must be recorded over an interval of at least 3,000 ft (900 m).	X	X	X	X	The stabilized descent should be conducted with speed brakes extended, if applicable, at mid-altitude and near V_{mo} speed or in accordance with emergency descent procedures.
1.e.	Stopping								

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
1.e.1.	Stopping time and distance, using manual application of wheel brakes and no reverse thrust on a dry runway.	±5% of time. For distance up to 4000 ft (1220 m): ±200 ft (61 m) or ±10%, whichever is smaller. For distance greater than 4000 ft (1220 m): ±5% of distance.	Landing	Record time and distance for at least 80% of the total time from touch down to full stop. Data is required for weights at medium and near maximum landing weights. Data for brake system pressure and position of ground spoilers (including method of deployment, if used) must be provided. Engineering data may be used for the medium gross weight condition.	X	X	X	X	
1.e.2.	Stopping time and distance, using reverse thrust and no wheel brakes on a dry runway.	±5% time and the smaller of ±10% or ±200 ft (61 m) of distance.	Landing	Record time and distance for at least 80% of the total time from initiation of reverse thrust to the minimum operating speed with full reverse thrust. Data is required for medium and near maximum landing gross weights. Data on the position of ground spoilers, (including method of deployment, if used) must be provided. Engineering data may be used for the medium gross weight condition.	X	X	X	X	
1.e.3.	Stopping distance, using wheel brakes and no reverse thrust on a wet runway.	±10% of distance or ±200 ft (61 m).	Landing	Either flight test data or manufacturer's performance manual data must be used where available. Engineering data based on dry runway flight test stopping distance modified by the effects of contaminated runway braking coefficients are an acceptable alternative.			X	X	
1.e.4.	Stopping distance, using wheel brakes and no reverse thrust on an icy runway.	±10% of distance or ±200 ft (61 m).	Landing	Either flight test or manufacturer's performance manual data must be used, where available. Engineering data based on dry runway flight test stopping distance modified by the effects of contaminated runway braking coefficients are an acceptable alternative.			X	X	
1.f.	Engines								

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
1.f.1.	Acceleration	±10% T_t and ±10% T_i, or ±0.25 sec.	Approach or landing	Record engine power (N_1, N_2, EPR, Torque) from flight idle to go-around power for a rapid (slam) throttle movement.	X	X	X	X	T_i, is the total time from initial throttle movement until reaching a 10% response of engine power. T_t is the total time from initial throttle movement to reaching 90% of go around power.
1.f.2.	Deceleration	±10% T_t and ±10% T_i, or ±0.25 sec.	Ground	Record engine power (N_1, N_2, EPR, Torque) from Max T/O power to 90% decay of Max T/O power for a rapid (slam) throttle movement.	X	X	X	X	T_i, is the total time from initial throttle movement until reaching a 10% response of engine power. T_t is the total time from initial throttle movement to reaching 90% decay of maximum takeoff power.
2. Handling Qualities									
	For simulators requiring Static or Dynamic tests at the controls (i.e., column, wheel, rudder pedal), special test fixtures will not be required during initial or upgrade evaluations if the sponsor's QTG/MQTG shows both test fixture results *and* the results of an alternative approach, such as computer plots produced concurrently, that provide satisfactory agreement. Repeat of the alternative method during the initial or upgrade evaluation would then satisfy this test requirement. For initial and upgrade evaluations, the control dynamic characteristics must be measured at and recorded directly from the flight deck controls, and must be accomplished in takeoff, cruise, and landing flight conditions and configurations. Testing of position versus force is not applicable if forces are generated solely by use of airplane hardware in the full flight simulator								Contact the NSPM for clarification of any issue regarding airplanes with reversible controls.
2.a.	Static Control Tests								
2.a.1.a.	Pitch Controller Position vs. Force and Surface Position Calibration.	±2 lb (0.9 daN) breakout, ±10% or ±5 lb (2.2 daN) force, ±2° elevator.	Ground	Record results for an uninterrupted control sweep to the stops.	X	X	X	X	Test results should be validated (where possible) with in-flight data from tests such as longitudinal static stability or stalls. Static and dynamic flight control tests should be accomplished at the same feel or impact pressures.
2.a.1.b.	(Reserved)								
2.a.2.a.	Roll Controller Position vs. Force and Surface Position Calibration.	±2 lb (0.9 daN) breakout, ±10% or ±3 lb (1.3 daN) force, ±2° aileron, ±3° spoiler angle.	Ground	Record results for an uninterrupted control sweep to the stops.	X	X	X	X	Test results should be validated with in-flight data from tests such as engine out trims, steady state or sideslips. Static and dynamic flight control tests should be accomplished at the same feel or impact pressures.
2.a.2.b.	(Reserved)								
2.a.3.a.	Rudder Pedal Position vs. Force and Surface Position Calibration.	±5 lb (2.2 daN) breakout, ±10% or ±5 lb (2.2 daN) force, ±2° rudder angle.	Ground	Record results for an uninterrupted control sweep to the stops.	X	X	X	X	Test results should be validated with in-flight data from tests such as engine out trims, steady state or sideslips. Static and dynamic flight control tests should be accomplished at the same feel or impact pressures.

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
2.a.3.b.	(Reserved)								
2.a.4.	Nosewheel Steering Controller Force and Position Calibration.	±2 lb (0.9 daN) breakout, ±10% or ±3 lb (1.3 daN) force, ±2° nosewheel angle.	Ground	Record results of an uninterrupted control sweep to the stops.	X	X	X	X	
2.a.5.	Rudder Pedal Steering Calibration.	±2° nosewheel angle	Ground	Record results of an uninterrupted control sweep to the stops.	X	X	X	X	
2.a.6.	Pitch Trim Indicator vs. Surface Position Calibration.	±0.5° of computed trim surface angle.	Ground		X	X	X	X	The purpose of the test is to compare full flight simulator against design data or equivalent.
2.a.7.	Pitch Trim Rate	±10% trim rate (°/sec)	Ground and approach	The trim rate must be checked using the pilot primary trim (ground) and using the autopilot or pilot primary trim in flight at go-around flight conditions.	X	X	X	X	
2.a.8.	Alignment of Flight Deck Throttle Lever vs. Selected Engine Parameter.	±5° of throttle lever angle, or ±3% N1, or ±.03 EPR, or ±3% maximum rated manifold pressure, or ±3% torque. For propeller-driven airplanes where the propeller control levers do not have angular travel, a tolerance of ±0.8 inch (±2 cm) applies.	Ground	Requires simultaneous recording for all engines. The tolerances apply against airplane data and between engines. In the case of propeller powered airplanes, if a propeller lever is present, it must also be checked. For airplanes with throttle "detents," all detents must be presented. May be a series of snapshot test results.	X	X	X	X	
2.a.9.	Brake Pedal Position vs. Force and Brake System Pressure Calibration.	±5 lb (2.2 daN) or 10% force, ±150 psi (1.0 MPa) or ±10% brake system pressure.	Ground	Hydraulic system pressure must be related to pedal position through a ground static test.	X	X	X	X	Full flight simulator computer output results may be used to show compliance.
2.b.	Dynamic Control Tests								
	Tests 2.b.1., 2.b.2., and 2.b.3. are not applicable if dynamic response is generated solely by use of airplane hardware in the full flight simulator. Power setting is that required for level flight unless otherwise specified.								

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
2.b.1.	Pitch Control	For underdamped systems: ±10% of time from 90% of initial displacement (0.9 A_d) to first zero crossing and ±10 (n+1)% of period thereafter. ±10% amplitude of first overshoot applied to all overshoots greater than 5% of initial displacement (.05 A_d). ±1 overshoot (first significant overshoot must be matched). For overdamped systems: ±10% of time from 90% of initial displacement (0.9 A_d) to 10% of initial displacement (0.1 A_d). For the alternate method see paragraph 4 of this attachment. The slow sweep is the equivalent to the static test 2.a.1. For the moderate and rapid sweeps: ±2 lb (0.9 daN) or ±10% dynamic increment above the static force.	Takeoff, Cruise, and Landing.	Data must show normal control displacement in both directions. Tolerances apply against the absolute values of each period (considered independently). Normal control displacement for this test is 25% to 50% of full throw or 25% to 50% of the maximum allowable pitch controller deflection for flight conditions limited by the maneuvering load envelope.			X	X	"n" is the sequential period of a full cycle of oscillation. Refer to paragraph 4 of this attachment for more information. Static and dynamic flight control tests should be accomplished at the same feel or impact pressures.
2.b.2.	Roll Control	For underdamped systems: ±10% of time from 90% of initial displacement (0.9 A_d) to first zero crossing, and ±10 (n+1)% of period thereafter. ±10% amplitude of first overshoot, applied to all overshoots greater than 5% of initial displacement (.05 A_d), ±1 overshoot (first significant overshoot must be matched). For overdamped systems: ±10% of time from 90% of initial displacement (0.9 A_d) to 10% of initial displacement (0.1A_d). For the alternate method see paragraph 4 of this attachment. The slow sweep is the equivalent to the static test 2.a.2. For the moderate and rapid sweeps: ±2 lb (0.9 daN) or ±10% dynamic increment above the static force.	Takeoff, Cruise, and Landing.	Data must show normal control displacement in both directions. Tolerances apply against the absolute values of each period (considered independently). Normal control displacement for this test is 25% to 50% of full throw or 25% to 50% of maximum allowable roll controller deflection for flight conditions limited by the maneuvering load envelope.			X	X	"n" is the sequential period of a full cycle of oscillation. Refer to paragraph 4 of this attachment for more information. Static and dynamic flight control tests should be accomplished at the same feel or impact pressures.

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
2.b.3.	Yaw Control	For underdamped systems: ±10% of time from 90% of initial displacement (0.9 A_d) to first zero crossing, and ±10 (n+1)% of period thereafter. ±10% amplitude of first overshoot applied to all overshoots greater than 5% of initial displacement (.05 A_d). ±1 overshoot (first significant overshoot must be matched). For overdamped systems: ±10% of time from 90% of initial displacement (0.9 A_d) to 10% of initial displacement (0.1A_d). For the alternate method (see paragraph 4 of this attachment). The slow sweep is the equivalent to the static test 2.a.3. For the moderate and rapid sweeps: ±2 lb (0.9 daN) or ±10% dynamic increment above the static force.	Takeoff, Cruise, and Landing.	Data must show normal control displacement in both directions. Tolerances apply against the absolute values of each period (considered independently). Normal control displacement for this test is 25% to 50% of full throw.			X	X	"n" is the sequential period of a full cycle of oscillation. Refer to paragraph 4 of this attachment for more information. Static and dynamic flight control tests should be accomplished at the same feel or impact pressures.
2.b.4.	Small Control Inputs—Pitch.	±0.15°/sec body pitch rate or ±20% of peak body pitch rate applied throughout the time history.	Approach or Landing ..	Control inputs must be typical of minor corrections made while established on an ILS approach course, using from 0.5°/sec to 2°/sec pitch rate. The test must be in both directions, showing time history data from 5 seconds before until at least 5 seconds after initiation of control input. **CCA:** Test in normal and non-normal control states.			X	X	

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
2.b.5.	Small Control Inputs—Roll.	±0.15°/sec body roll rate or ±20% of peak body roll rate applied throughout the time history.	Approach or landing ...	Control inputs must be typical of minor corrections made while established on an ILS approach course, using from 0.5°/sec to 2°/sec roll rate. The test may be run in only one direction; however, for airplanes that exhibit non-symmetrical behavior, the test must include both directions. Time history data must be recorded from 5 seconds before until at least 5 seconds after initiation of control input. **CCA:** Test in normal and non-normal control states.			X	X	
2.b.6.	Small Control Inputs—Yaw.	±0.15°/sec body yaw rate or ±20% of peak body yaw rate applied throughout the time history.	Approach or landing ...	Control inputs must be typical of minor corrections made while established on an ILS approach course, using from 0.5°/sec to 2°/sec yaw rate. The test may be run in only one direction; however, for airplanes that exhibit non-symmetrical behavior, the test must include both directions. Time history data must be recorded from 5 seconds before until at least 5 seconds after initiation of control input. **CCA:** Test in normal and non-normal control states.			X	X	
2.c.	Longitudinal Control Tests								
	Power setting is that required for level flight unless otherwise specified.								
2.c.1.	Power Change Dynamics.	±3 kt airspeed, ±100 ft (30 m) altitude, ±20% or ±1.5° pitch angle.	Approach	Power is changed from the thrust setting required for approach or level flight to maximum continuous thrust or go-around power setting. Record the uncontrolled free response from at least 5 seconds before the power change is initiated to 15 seconds after the power change is completed. **CCA:** Test in Normal and Non-normal control states.	X	X	X	X	

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
2.c.2.	Flap/Slat Change Dynamics.	±3 kt airspeed, ±100 ft (30 m) altitude, ±20% or ±1.5° pitch angle.	Takeoff through initial flap retraction, and approach to landing.	Record the uncontrolled free response from at least 5 seconds before the configuration change is initiated to 15 seconds after the configuration change is completed. **CCA:** Test in normal and non-normal control states.	X	X	X	X	
2.c.3.	Spoiler/Speedbrake Change Dynamics.	±3 kt airspeed, ±100 ft (30 m) altitude, ±20% or ±1.5° pitch angle.	Cruise	Record the uncontrolled free response from at least 5 seconds before the configuration change is initiated to 15 seconds after the configuration change is completed. Record results for both extension and retraction. **CCA:** Test in normal and non-normal control states.	X	X	X	X	
2.c.4.	Gear Change Dynamics.	±3 kt airspeed, ±100 ft (30 m) altitude, ±20% or ±1.5° pitch angle.	Takeoff (retraction), and Approach (extension).	Record the time history of uncontrolled free response for a time increment from at least 5 seconds before the configuration change is initiated to 15 seconds after the configuration change is completed. **CCA:** Test in normal and non-normal control states.	X	X	X	X	
2.c.5.	Longitudinal Trim	±0.5° trim surface angle ±1° elevator ±1° pitch angle ±5% net thrust or equivalent.	Cruise, Approach, and Landing.	Record steady-state condition with wings level and thrust set for level flight. May be a series of snapshot tests. **CCA:** Test in normal and non-normal control states.	X	X	X	X	

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
2.c.6.	Longitudinal Maneuvering Stability (Stick Force/g).	±5 lb (±2.2 daN) or ±10% pitch controller force. Alternative method: ±1° or ±10% change of elevator.	Cruise, Approach, and Landing.	Continuous time history data or a series of snapshot tests may be used. Record results up to 30° of bank for approach and landing configurations. Record results for up to 45° of bank for the cruise configuration. The force tolerance is not applicable if forces are generated solely by the use of airplane hardware in the full flight simulator. The alternative method applies to airplanes that do not exhibit "stick-force-per-g" characteristics. **CCA:** Test in Normal and Non-normal control states.	X	X	X	X	
2.c.7.	Longitudinal Static Stability.	±5 lb (±2.2 daN) or ±10% pitch controller force. Alternative method: ±1° or ±10% change of elevator.	Approach	Record results for at least 2 speeds above and 2 speeds below trim speed. May be a series of snapshot test results. The force tolerance is not applicable if forces are generated solely by the use of airplane hardware in the full flight simulator. The alternative method applies to airplanes that do not exhibit speed stability characteristics. **CCA:** Test in Normal or Non-normal control states.	X	X	X	X	
2.c.8.	Stall Characteristics	±3 kt airspeed for initial buffet, stall warning, and stall speeds. ±2° bank for speeds greater than stick shaker or initial buffet. Additionally, for those simulators with reversible flight control systems: ±10% or ±5 lb (2.2 daN)) Stick/Column force (prior to "g break" only).	Second Segment Climb, and Approach or Landing.	The stall maneuver must be entered with thrust at or near idle power and wings level (1g). Record the stall warning signal and initial buffet, if applicable. Time history data must be recorded for full stall and initiation of recovery. The stall warning signal must occur in the proper relation to buffet/stall. Full flight simulators of airplanes exhibiting a sudden pitch attitude change or "g break" must demonstrate this characteristic. **CCA:** Test in Normal and Non-normal control states.	X	X	X	X	

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
2.c.9.	Phugoid Dynamics	±10% period, ±10% of time to ½ or double amplitude or ±.02 of damping ratio.	Cruise	The test must include whichever is less of the following: Three full cycles (six overshoots after the input is completed), or the number of cycles sufficient to determine time to ½ or double amplitude. **CCA:** Test in Non-normal control states.	X	X	X	X	
2.c.10.	Short Period Dynamics	±1.5° pitch angle or ±2°/sec pitch rate, ±0.10g acceleration.	Cruise	**CCA:** Test in Normal and Non-normal control states.		X	X	X	
2.c.11.	(Reserved)								
2.d.	Lateral Directional Tests								
	Power setting is that required for level flight unless otherwise specified.								
2.d.1.	Minimum Control Speed, Air (V_{mca} or V_{mci}), per Applicable Airworthiness Standard or Low Speed Engine Inoperative Handling Characteristics in the Air.	±3 kt airspeed	Takeoff or Landing (whichever is most critical in the airplane).	Takeoff thrust must be used on the operating engine(s). A time history or a series of snapshot tests may be used. **CCA:** Test in Normal and Non-normal control states.	X	X	X	X	Low Speed Engine Inoperative Handling may be governed by a performance or control limit that prevents demonstration of V_{mca} in the conventional manner.
2.d.2.	Roll Response (Rate)	±10% or ±2°/sec roll rate. Additionally, for those simulators of airplanes with reversible flight control systems: ±10% or ±3lb (1.3 daN) wheel force.	Cruise, and Approach or Landing.	Record results for normal roll controller deflection (about one-third of maximum roll controller travel). May be combined with step input of flight deck roll controller test (2.d.3.).	X	X	X	X	
2.d.3.	Roll Response to Flight deck Roll Controller Step Input.	±10% or ±2° bank angle.	Approach or Landing	Record from initiation of roll through 10 seconds after control is returned to neutral and released. May be combined with roll response (rate) test (2.d.2). **CCA:** Test in Normal and Non-normal control states.	X	X	X	X	With wings level, apply a step roll control input using approximately one-third of the roll controller travel. When reaching approximately 20° to 30° of bank, abruptly return the roll controller to neutral and allow approximately 10 seconds of airplane free response.
2.d.4.	Spiral Stability	Correct trend and ±2° or ±10% bank angle in 20 seconds. Alternate test requires correct trend and ±2° aileron.	Cruise, and Approach or Landing.	Record results for both directions. Airplane data averaged from multiple tests may be used. As an alternate test, demonstrate the lateral control required to maintain a steady turn with a bank angle of 28° to 32°. **CCA:** Test in Normal and Non-normal control states.	X	X	X	X	

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
2.d.5.	Engine Inoperative Trim.	±1° rudder angle or ±1° tab angle or equivalent pedal, ±2° sideslip angle.	Second Segment Climb, and Approach or Landing.	May be a series of snapshot tests.	X	X	X	X	The test should be performed in a manner similar to that for which a pilot is trained to trim an engine failure condition. Second segment climb test should be at takeoff thrust. Approach or landing test should be at thrust for level flight.
2.d.6.	Rudder Response	±2°/sec or ±10% yaw rate..	Approach or Landing ..	Record results for stability augmentation system ON and OFF. A rudder step input of 20%–30% rudder pedal throw is used. **CCA:** Test in Normal and Non-normal control states.	X	X	X	X	
2.d.7.	Dutch Roll, (Yaw Damper OFF).	±0.5 sec or ±10% of period, ±10% of time to ½ or double amplitude or ±.02 of damping ratio. ±20% or ±1 sec of time difference between peaks of bank and sideslip.	Cruise, and Approach or Landing.	Record results for at least 6 complete cycles with stability augmentation OFF. **CCA:** Test in Non-normal control states.	X	X	X	X	
2.d.8.	Steady State Sideslip	For given rudder position ±2° bank angle, ±1° sideslip angle, ±10% or ±2° aileron, ±10% or ±5° spoiler or equivalent roll, controller position or force. Additionally, for those simulators of airplanes with reversible flight control systems: ±10% or ±3 lb (1.3 daN) wheel force ±10% or ±5 lb (2.2 daN) rudder pedal force.	Approach or Landing ..	May be a series of snapshot test results using at least two rudder positions. Propeller driven airplanes must test in each direction.	X	X	X	X	
2.e.	Landings								
2.e.1.	Normal Landing	±3 kt airspeed, ±1.5° pitch angle, ±1.5° angle of attack, ±10% or ±10 ft (3 m) height. Additionally, for those simulators of airplanes with reversible flight control systems: ±10% or ±5 lbs (±2.2 daN) stick/column force	Landing	Record results from a minimum of 200 ft (61 m) AGL to nosewheel touchdown. **CCA:** Test in Normal and Non-normal control states.		X	X	X	Tests should be conducted with two normal landing flap settings (if applicable). One should be at or near maximum certificated landing weight. The other should be at light or medium landing weight.

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
2.e.2.	Minimum Flap Landing	±3 kt airspeed, ±1.5° pitch angle, ±1.5° angle of attack, ±10% or ±10 ft (3 m) height. Additionally, for those simulators of airplanes with reversible flight control systems: ±10% or ±5 lbs (2.2 daN) stick/column force.	Minimum Certified Landing Flap Configuration.	Record results from a minimum of 200 ft (61 m) AGL to nosewheel touchdown with airplane at or near Maximum Landing Weight.			X	X	
2.e.3.	Crosswind Landing	±3 kt airspeed, ±1.5° pitch angle, ±1.5° angle of attack, ±10% or ±10 ft (3 m) height ±2° bank angle, ±2° sideslip angle ±3° heading angle. Additionally, for those simulators of airplanes with reversible flight control systems: ±10% or ±3 lb (1.3 daN) wheel force ±10% or ±5 lb (2.2 daN) rudder pedal force.	Landing	Record results from a minimum of 200 ft (61 m) AGL, through nosewheel touchdown, to 50% decrease in main landing gear touchdown speed. Test data must include information on wind profile, for a crosswind component of 60% of the maximum wind measured at 33 ft (10 m) above the runway.		X	X	X	In those situations where a maximum crosswind or a maximum demonstrated crosswind is not known, contact the NSPM.
2.e.4.	One Engine Inoperative Landing.	±3 kt airspeed, ±1.5° pitch angle, ±1.5° angle of attack, ±10% height or ±10 ft (3 m); ±2° bank angle, ±2° sideslip angle, ±3° heading.	Landing	Record results from a minimum of 200 ft (61 m) AGL, through nosewheel touchdown, to 50% decrease in main landing gear touchdown speed or less.		X	X	X	
2.e.5.	Autopilot landing (if applicable).	±5 ft (1.5 m) flare height, ±0.5 sec T_f, or ±10%T_f, ±140 ft/min (0.7 m/sec) rate of descent at touchdown. ±10 ft (3 m) lateral deviation during rollout.	Landing	If autopilot provides rollout guidance, record lateral deviation from touchdown to a 50% decrease in main landing gear touchdown speed or less. Time of autopilot flare mode engage and main gear touchdown must be noted.		X	X	X	T_f = duration of flare.
2.e.6.	All engines operating, autopilot, go around.	±3 kt airspeed, ±1.5° pitch angle, ±1.5° angle of attack.		Normal, all-engines-operating, Go Around with the autopilot engaged (if applicable) at medium landing weight. **CCA:** Test in Normal and Non-normal control states.		X	X	X	

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
2.e.7.	One engine inoperative go around.	±3 kt airspeed, ±1.5° pitch angle, ±1.5° angle of attack, ±2° bank angle, ±2° slideslip angle.		The one engine inoperative go around is required at near maximum certificated landing weight with the critical engine inoperative using manual controls. If applicable, an additional engine inoperative go around test must be accomplished with the autopilot engaged. **CCA:** Test in Normal and Non-normal control states.		X	X	X	
2.e.8.	Directional control (rudder effectiveness) with symmetric reverse thrust.	±2°/sec yaw rate ±5 kts airspeed.	Landing	Record results starting from a speed approximating touchdown speed to the minimum thrust reverser operation speed. With full reverse thrust, apply yaw control in both directions until reaching minimum thrust reverser operation speed.		X	X	X	
2.e.9.	Directional control (rudder effectiveness) with asymmetric reverse thrust.	±5 kt airspeed, ±3° heading angle.	Landing	Maintain heading with yaw control with full reverse thrust on the operating engine(s). Record results starting from a speed approximating touchdown speed to a speed at which control of yaw cannot be maintained or until reaching minimum thrust reverser operation speed, whichever is higher. The tolerance applies to the low speed end of the data recording.		X	X	X	
2.f.	Ground Effect								
	Test to demonstrate Ground Effect.	±1° elevator ±0.5°stabilizer angle, ±5% net thrust or equivalent, ±1° angle of attack, ±10% height or ±5 ft (1.5 m), ±3 kt airspeed, ±1° pitch angle.	Landing	The Ground Effect model must be validated by the test selected and a rationale must be provided for selecting the particular test.		X	X	X	See paragraph on Ground Effect in this attachment for additional information.
2.g.	Windshear								
	Four tests, two takeoff and two landing, with one of each conducted in still air and the other with windshear active to demonstrate windshear models.	See Attachment 5	Takeoff and Landing	Requires windshear models that provide training in the specific skills needed to recognize windshear phenomena and to execute recovery procedures. See Attachment 5 for tests, tolerances, and procedures.			X	X	See Attachment 5 for information related to Level A and B simulators.
2.h.	Flight Maneuver and Envelope Protection Functions								

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
	The requirements of tests h(1) through (6) of this attachment are applicable to computer controlled airplanes only. Time history results are required for simulator response to control inputs during entry into envelope protection limits including both normal and degraded control states if the function is different. Set thrust as required to reach the envelope protection function.								
2.h.1.	Overspeed	±5 kt airspeed	Cruise			X	X	X	
2.h.2.	Minimum Speed	±3 kt airspeed	Takeoff, Cruise, and Approach or Landing.			X	X	X	
2.h.3.	Load Factor	±0.1g normal load factor.	Takeoff, Cruise			X	X	X	
2.h.4.	Pitch Angle	±1.5° pitch angle	Cruise, Approach			X	X	X	
2.h.5.	Bank Angle	±2° or ±10% bank angle.	Approach			X	X	X	
2.h.6.	Angle of Attack	±1.5° angle of attack	Second Segment Climb, and Approach or Landing.			X	X	X	
3. Motion System									
3.a.	Frequency response								
		Based on Simulator Capability.	N/A	The test must demonstrate frequency response of the motion system.	X	X	X	X	This test is not required as part of continuing qualification evaluations, and should be part of the MQTG.
3.b.	Leg balance								
		Based on Simulator Capability.	N/A	Required as part of MQTG but not required to be scheduled as part of continuing qualification evaluations. The test must demonstrate motion system leg balance as specified by the applicant for flight simulator qualification.	X	X	X	X	
3.c.	Turn-around check								
		Based on Simulator Capability.	N/A	Required as part of MQTG but not required to be scheduled as part of continuing qualification evaluations. The test must demonstrate a smooth turn-around (shift to opposite direction of movement) of the motion system as specified by the applicant for flight simulator qualification.	X	X	X	X	
3.d.	Motion system repeatability								

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
		With the same input signal, the test results must be repeatable to within ±0.05g actual platform linear acceleration.	Accomplished in both the "ground" mode and in the "flight" mode of the motion system operation.	A demonstration is required and must be made part of the MQTG. The assessment procedures must be designed to ensure that the motion system hardware and software (in normal flight simulator operating mode) continue to perform as originally qualified.	X	X	X	X	This test ensures that motion system hardware and software (in normal flight simulator operating mode) continue to perform as originally qualified. Performance changes from the original baseline can be readily identified with this information.
3.e.	Motion cueing performance signature.								
	Required as part of MQTG but not required as part of continuing evaluations.								These tests should be run with the motion buffet mode disabled. See paragraph 5.d., of this attachment, Motion cueing performance signature.
3.e.1.	Takeoff rotation (V_R to V_2).	As specified by the sponsor for flight simulator qualification.	Ground	Pitch attitude due to initial climb must dominate over cab tilt due to longitudinal acceleration.	X	X	X	X	Associated with test 1.b.4.
3.e.2.	Engine failure between V_1 and V_R.	As specified by the sponsor for flight simulator qualification.	Ground		X	X	X	X	Associated with test 1.b.5.
3.e.3.	Pitch change during go-around.	As specified by the sponsor for flight simulator qualification.	Flight			X	X	X	Associated with test 2.e.6.
3.e.4.	Configuration changes	As specified by the sponsor for flight simulator qualification.	Flight		X	X	X	X	Associated with tests 2.c.2. and 2.c.4.
3.e.5.	Power change dynamics.	As specified by the sponsor for flight simulator qualification.	Flight		X	X	X	X	Associated with test 2.c.1.
3.e.6.	Landing flare	As specified by the sponsor for flight simulator qualification.	Flight			X	X	X	Associated with test 2.e.1.
3.e.7.	Touchdown bump	As specified by the sponsor for flight simulator qualification.	Ground				X	X	Associated with test 2.e.1.
3.f.	Characteristic motion vibrations								
	The recorded test results for characteristic buffets must allow the comparison of relative amplitude versus frequency.								
3.f.1.	Thrust effect with brakes set.	Simulator test results must exhibit the overall appearance and trends of the airplane data, with at least three (3) of the predominant frequency "spikes" being present within ±2 Hz.	Ground	The test must be conducted within 5% of the maximum possible thrust with brakes set.				X	

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
3.f.2.	Buffet with landing gear extended.	Simulator test results must exhibit the overall appearance and trends of the airplane data, with at least three (3) of the predominant frequency ''spikes'' being present within ±2 Hz.	Flight	The test must be conducted at a nominal, mid-range airspeed; i.e., sufficiently below landing gear limiting airspeed to avoid inadvertently exceeding this limitation.				X	
3.f.3.	Buffet with flaps extended.	Simulator test results must exhibit the overall appearance and trends of the airplane data, with at least three (3) of the predominant frequency ''spikes'' being present within ±2 Hz.	Flight	The test must be conducted at a nominal, mid-range airspeed; i.e., sufficiently below flap extension limiting airspeed to avoid inadvertently exceeding this limitation.				X	
3.f.4.	Buffet with speedbrakes deployed.	Simulator test results must exhibit the overall appearance and trends of the airplane data, with at least three (3) of the predominant frequency ''spikes'' being present within ±2 Hz.	Flight					X	
3.f.5.	Buffet at approach-to-stall.	Simulator test results must exhibit the overall appearance and trends of the airplane data, with at least three (3) of the predominant frequency ''spikes'' being present within ±2 Hz.	Flight	The test must be conducted for approach to stall. Post stall characteristics are not required.				X	
3.f.6.	Buffet at high airspeeds or high Mach.	Simulator test results must exhibit the overall appearance and trends of the airplane data, with at least three (3) of the predominant frequency ''spikes'' being present within ±2 Hz.	Flight					X	The test may be conducted during either a high speed maneuver (e.g., ''wind-up'' turn) or at high Mach.
3.f.7.	In-flight vibrations for propeller driven airplanes.	Simulator test results must exhibit the overall appearance and trends of the airplane data, with at least three (3) of the predominant frequency ''spikes'' being present within ±2 Hz.	Flight (clean configuration).					X	
4. Visual System									
4.a.	Visual System Response Time: (Choose either test 4.a.1. or 4.a.2. to satisfy test 4.a., Visual System Response Time Test. This test also suffices for motion system response timing and flight deck instrument response timing.)								See additional information in this attachment.
4.a.1.	Latency								

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
		300 ms (or less) after airplane response.	Take-off, cruise, and approach or landing.	One test is required in each axis (pitch, roll and yaw) for each of the three conditions (take-off, cruise, and approach or landing).	X	X			The visual scene or test pattern used during the response testing should be representative of the system capacities required to meet the daylight, twilight (dusk/dawn) and/or night visual capability as appropriate.
		150 ms (or less) after airplane response.	Take-off, cruise, and approach or landing.	One test is required in each axis (pitch, roll and yaw) for each of the three conditions (take-off, cruise, and approach or landing).			X	X	
4.a.2.	Transport Delay								
		300 ms (or less) after controller movement.	N/A	A separate test is required in each axis (pitch, roll, and yaw).	X	X			If Transport Delay is the chosen method to demonstrate relative responses, the sponsor and the NSPM will use the latency values to ensure proper simulator response when reviewing those existing tests where latency can be identified (e.g., short period, roll response, rudder response).
		150 ms (or less) after controller movement.	N/A	A separate test is required in each axis (pitch, roll, and yaw).			X	X	
4.b.	Field of View								
4.b.1.	Continuous collimated visual field of view.	Continuous collimated field of view providing at least 45° horizontal and 30° vertical field of view for each pilot seat. Both pilot seat visual systems must be operable simultaneously.	N/A	Required as part of MQTG but not required as part of continuing evaluations.	X	X			A vertical field of view of 30° may be insufficient to meet visual ground segment requirements.
4.b.2.	(Reserved)								

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
4.b.3.	Continuous, collimated, field of view.	Continuous field of view of at least 176° horizontally and 36 vertically.	N/A	An SOC is required and must explain the geometry of the installation. Horizontal field of view must be at least 176° (including not less than 88° either side of the center line of the design eye point). Additional horizontal field of view capability may be added at the sponsor's discretion provided the minimum field of view is retained. Vertical field of view must be at least 36° from each pilot's eye point. Required as part of MQTG but not required as part of continuing qualification evaluations.			X	X	The horizontal field of view is traditionally described as a 180° field of view. However, the field of view is technically no less than 176°. Field of view should be measured using a visual test pattern filling the entire visual scene (all channels) with a matrix of black and white 5° squares. The installed alignment should be addressed in the SOC.
4.c.	(System geometry)								
		5° even angular spacing within ±1° as measured from either pilot eye point and within 1.5° for adjacent squares.	N/A	The angular spacing of any chosen 5° square and the relative spacing of adjacent squares must be within the stated tolerances.	X	X	X	X	The purpose of this test is to evaluate local linearity of the displayed image at either pilot eye point. System geometry should be measured using a visual test pattern filling the entire visual scene (all channels) with a matrix of black and white 5° squares with light points at the intersections.
4.d.	Surface contrast ratio								
		Not less than 5:1	N/A	The ratio is calculated by dividing the brightness level of the center, bright square (providing at least 2 foot-lamberts or 7 cd/m2) by the brightness level of any adjacent dark square. This requirement is applicable to any level of simulator equipped with a daylight visual system.			X	X	Measurements should be made using a 1° spot photometer and a raster drawn test pattern filling the entire visual scene (all channels) with a test pattern of black and white squares, 5° per square, with a white square in the center of each channel. During contrast ratio testing, simulator aft-cab and flight deck ambient light levels should be zero.
4.e.	Highlight brightness								

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
		Not less than six (6) foot-lamberts (20 cd/m^2).	N/A	Measure the brightness of a white square while superimposing a highlight on that white square. The use of calligraphic capabilities to enhance the raster brightness is acceptable; however, measuring lightpoints is not acceptable. This requirement is applicable to any level of simulator equipped with a daylight visual system.			X	X	Measurements should be made using a 1° spot photometer and a raster drawn test pattern filling the entire visual scene (all channels) with a test pattern of black and white squares, 5° per square, with a white square in the center of each channel.
4.f.	Surface resolution								
		Not greater than two (2) arc minutes.	N/A	An SOC is required and must include the relevant calculations and an explanation of those calculations. This requirement is applicable to any level of simulator equipped with a daylight visual system.			X	X	The eye will subtend two arc minutes when positioned on a 3° glide slope, 6,876 ft slant range from the centrally located threshold of a black runway surface painted with white threshold bars that are 16 ft wide with 4-foot gaps between the bars.
4.g.	Light point size								
		Not greater than five (5) arc-minutes.	N/A	An SOC is required and must include the relevant calculations and an explanation of those calculations. This requirement is applicable to any level of simulator equipped with a daylight visual system.			X	X	Light point size should be measured using a test pattern consisting of a centrally located single row of light points reduced in length until modulation is just discernible in each visual channel. A row of 48 lights will form a 4° angle or less.
4.h.	Light point contrast ratio								
4.h.1.	For Level A and B simulators.	Not less than 10:1	N/A	An SOC is required and must include the relevant calculations.	X	X			A 1° spot photometer is used to measure a square of at least 1° filled with light points (where light point modulation is just discernible) and compare the results to the measured adjacent background. During contrast ratio testing, simulator aft-cab and flight deck ambient light levels should be zero.

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
4.h.2.	For Level C and D simulators.	Not less than 25:1	N/A	An SOC is required and must include the relevant calculations.			X	X	A 1° spot photometer is used to measure a square of at least 1° filled with light points (where light point modulation is just discernible) and compare the results to the measured adjacent background. During contrast ratio testing, simulator aft-cab and flight deck ambient light levels should be zero.
4.i.	Visual ground segment								
		The visible segment in the simulator must be within 20% of the segment computed to be visible from the airplane flight deck. The tolerance(s) may be applied at either or both ends of the displayed segment. However, lights and ground objects computed to be visible from the airplane flight deck at the near end of the visible segment must be visible in the simulator.	Landing configuration, trimmed for appropriate airspeed, at 100 ft (30 m) above the touchdown zone, on glide slope with an RVR value set at 1,200 ft (350 m).	The QTG must contain appropriate calculations and a drawing showing the pertinent data used to establish the airplane location and the segment of the ground that is visible considering design eyepoint, the airplane attitude, flight deck cut-off angle, and a visibility of 1,200 ft (350 m) RVR. Simulator performance must be measured against the QTG calculations. The data submitted must include at least the following: (1) Static airplane dimensions as follows: (i) Horizontal and vertical distance from main landing gear (MLG) to glideslope reception antenna. (ii) Horizontal and vertical distance from MLG to pilot's eyepoint. (iii) Static flight deck cutoff angle.	X	X	X	X	Pre-position for this test is encouraged but may be achieved via manual or autopilot control to the desired position.
				(2) Approach data as follows: (i) Identification of runway. (ii) Horizontal distance from runway threshold to glideslope intercept with runway. (iii) Glideslope angle. (iv) Airplane pitch angle on approach. (3) Airplane data for manual testing: (i) Gross weight. (ii) Airplane configuration.					

TABLE A2A.—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

<<<QPS requirements>>>									Information notes
Test		Tolerance	Flight conditions	Test details	Simulator level				
Number	Title				A	B	C	D	
				(iii) Approach airspeed. If non-homogenous fog is used to obscure visibility, the vertical variation in horizontal visibility must be described and be included in the slant range visibility calculation used in the computations.					
5. Sound System									
The sponsor will not be required to repeat the airplane tests (i.e., tests 5.a.1. through 5.a.8. (or 5.b.1. through 5.b.9.) and 5.c., as appropriate) during continuing qualification evaluations if frequency response and background noise test results are within tolerance when compared to the initial qualification evaluation results, and the sponsor shows that no software changes have occurred that will affect the airplane test results. If the frequency response test method is chosen and fails, the sponsor may elect to fix the frequency response problem and repeat the test or the sponsor may elect to repeat the airplane tests. If the airplane tests are repeated during continuing qualification evaluations, the results may be compared against initial qualification evaluation results or airplane master data.									
5.a.	Turbo-jet airplanes								
5.a.1.	Ready for engine start	±5 dB per ⅓ octave band.	Ground	Normal conditions prior to engine start with the Auxiliary Power Unit operating, if appropriate.				X	
5.a.2.	All engines at idle	±5 dB per ⅓ octave band.	Ground	Normal condition prior to takeoff.				X	
5.a.3.	All engines at maximum allowable thrust with brakes set.	±5 dB per ⅓ octave band.	Ground	Normal condition prior to takeoff.				X	
5.a.4.	Climb	±5 dB per ⅓ octave band.	En-route climb	Medium altitude				X	
5.a.5.	Cruise	±5 dB per ⅓ octave band.	Cruise	Normal cruise configuration.				X	
5.a.6.	Speedbrake/spoilers extended (as appropriate).	±5 dB per ⅓ octave band.	Cruise	Normal and constant speedbrake deflection for descent at a constant airspeed and power setting.				X	
5.a.7.	Initial approach	±5 dB per ⅓ octave band.	Approach	Constant airspeed, gear up, flaps and slats, as appropriate.				X	
5.a.8.	Final approach	±5 dB per ⅓ octave band.	Landing	Constant airspeed, gear down, full flaps.				X	
5.b.	Propeller airplanes								
5.b.1.	Ready for engine start	±5 dB per ⅓ octave band.	Ground	Normal conditions prior to engine start with the Auxiliary Power Unit operating, if appropriate.				X	
5.b.2.	All propellers feathered	±5 dB per ⅓ octave band.	Ground	Normal condition prior to takeoff.				X	
5.b.3.	Ground idle or equivalent.	±5 dB per ⅓ octave band.	Ground	Normal condition prior to takeoff.				X	
5.b.4.	Flight idle or equivalent	±5 dB per ⅓ octave band.	Ground	Normal condition prior to takeoff.				X	